

ENDODNTICS

According to the buccal object rule, the image of the buccal object moves relative to the image of the lingual object. The image will move in the opposite direction that the x-ray beam is directed.

- a. Both statements are true
- b. Both statements are false
- c. First statement is true, second is false
- d. First statement is false, second is truth

Answer: C

SLOB – Same Lingual Opposite Buccal

The buccal object rule refers to the direction of the x-ray *beam*. So the image should move in the same direction as the beam. This technique allows a method of distinguishing between objects, defects, foreign bodies and/or canals. The principle states that the object closest to the buccal surface appears to move in the direction opposite the movement of the cone or tube head, when compared to a second film.

Pathways of the Pulp, 6th ed. Cohen et al. 1994: 93-95.

External root resorption may be attributed to which of the following?

- 1). Tumors and cysts
 - 2). Impacted teeth
 - 3). Excessive mechanical or occlusal forces
 - 4). Periapical inflammation.
-
- A. (1) and (2)
 - B. (2) and (3)
 - C. (1), (2), and (3)
 - D. (2), (3) and (4)
 - E. all of the above

Answer: E

External root resorption initiates in the periodontium, affecting the external surface of the tooth and is NOT initiated from within the pulp. It may or may not invade the dental pulp. Radiographically, the radiolucency may appear superimposed over the canal space, but the defect WILL SHIFT as the tube head angulation changes. Any of the following may cause external resorption:

- Excessive Mechanical Forces
- Impacted teeth
- Periapical inflammation
- Tumors or cysts

Internal resorption is a pathologic process that is “initiated within the pulp space with loss of dentin and possible invasion of the cementum; may or may not perforate to the external root surface”. *AAE Glossary* Radiographically, the radiolucency is well-centered and well-bordered. “Pink tooth” is not the sole indicator of internal resorption.

AAE Glossary

Pathways of the Pulp, 6th ed. Cohen et al. 1994:486-490.

During a routine exam, the dentist examines a radiograph with evidence of internal resorption in the middle third of an incisor. The patient is asymptomatic and pulp tests are vital. What should the dentist do?

- A. Do nothing and re-evaluate in 6 months
- B. Reduce the occlusion
- C. Perform a pulpotomy
- D. Perform endodontic therapy.

Answer: D

Internal resorption is a pathologic process that is “initiated within the pulp space with loss of dentin and possible invasion of the cementum; may or may not perforate to the external root surface”. *AAE Glossary*

Bacteria has invaded the pulp space and therefore full endodontic therapy is needed.

AAE Glossary

Pathways of the Pulp, 6th ed. Cohen et al. 1994:486-490.

A 25-year-old patient presents with pain in a non-restored, lower posterior tooth. What diagnostic tests would be MOST EFFECTIVE in determining cracked tooth syndrome?

- 1). EPT
 - 2). Fiberoptic light
 - 3). Tooth sleuth
 - 4). Radiographs
 - 5). Staining
-
- A. (1) and (5)
 - B. (1), (2) and (5)
 - C. (2), (3), and (5)
 - D. (1), (3), (4) and (5)
 - E. (4) and (5)

Answer: C

EPT – designed to stimulate a response by electric excitation of the neural elements within the pulp. This test does not provide sufficient information for a diagnosis, only suggests whether the pulp is vital or nonvital.

Fiberoptic Light – a suspected crack will block the light that is applied to the tooth's surface. Craze lines will not affect the illumination; the light will transmit throughout the crown.

Tooth Sleuth – helps to focus the biting pressures on specific cusps and reproduce the patient's chief complaint. ***Pain on releasing!!*** (hallmark sign)

Radiographs – very rarely do cracks show up on radiographs. Mesial-distal cracks can never be seen and buccal-lingual cracks only appear if there is actual separation of the segments.

Staining – using some sort of dye like methylene blue, can be applied to the external tooth surface or in a cavity once the restoration has been removed.

American Association of Endodontists. *Cracking the Cracked Tooth Code*. Fall/Winter 1997; 1-8.

Arrange the following teeth in order from the most likely to the least likely of having exactly two canals:

1. Maxillary 1st premolar
2. Maxillary 2nd premolar
3. Mandibular 1st premolar
4. Mandibular 2nd premolar

Possible answers:

- a. 1, 4, 3, 2
- b. 1, 3, 4, 2
- c. 1, 2, 3, 4
- d. 1, 2, 4, 3

Answer: c

The maxillary 1st premolar has 2 canals 85% of the time (Carns EJ, Skidmore AE. Configuration and deviation of root canals of maxillary first premolars. Oral Surg 1973; 36: 880-6.

The maxillary 1st premolar has 2 canals 80% of the time according to the textbook, Principles and Practices of Endodontics. Walton and Torabinejad. 1989. Pg 467.

The maxillary 2nd premolar has 2 canals 51% of the time (Vertucci FJ, Seelig A, Gillis R. Root canal morphology of the human maxillary second premolar. Oral Surg 1974; 38: 456-64.

The maxillary 2nd premolar has 2 canals 35% of the time according to the textbook, Principles and Practices of Endodontics. Walton and Torabinejad. 1989. Pg 468.

The mandibular first premolar has 2 canals 24% of the time (Vertucci FJ. Root canal morphology of mandibular premolars. J Am Dent Assoc 1978; 97: 47-50.

The mandibular 2nd premolar has 2 canals 2.5% of the time (Vertucci FJ. Root canal morphology of mandibular premolars. J Am Dent Assoc 1978; 97: 47-50.

The mandibular 2nd premolar has 2 canals 12% of the time according to the textbook, Principles and Practices of Endodontics. Walton and Torabinejad. 1989. Pg 475.

Most apical foramina deviate from the anatomic apex by the following amount:

- a. 1.0mm
- b. 1.2mm
- c. 0.59mm
- d. 0.52mm

Answer: c

92% of the major foramina deviated from the anatomic apices. The average deviation of the foramen from the anatomic apex was 0.59mm. (Burch JG, Hulen S. The relationship of the apical foramen to the anatomic apex of the tooth. Oral Surg 1972; 34: 262-8.

Which of the following statements are true for C-shaped canals:

- a. Most commonly seen in 1st molars.
- b. Predominate in Asians.
- c. Seen in 12% of 2nd molars.
- d. All of the above.

Answer: b

- Reported at 8% of second molars
- Appear to have Asian race predominance
- C-shaped canals have a single ribbon-shaped orifice with a 180° arc
- They start at the ML line angle and extend around the buccal ending at the distal aspect of the pulp chamber
- The canal morphology can be highly variable making instrumentation and obturation difficult
- You may need to consider extraction or replantation
- The shape can be broken down into 3 categories: Category 1 (continuous c-shape), category 2 (semicolon shape) and category 3 (separate, discrete canals).

- The configuration of the C-shaped canal changes as you proceed down the root which makes it extremely difficult to debride and obturate. Copious irrigation with NaOCl and use of sonics/ultrasonics can be helpful.

Cooke HG, Cox FL. C-shaped canal configurations in mandibular molars. J Am Dent Assoc 1979; 99: 836-9.

Melton DC, Krell KV, Fuller MW. Anatomical and histological features of C-shaped canals in mandibular second molars. J Endodon 1991; 17: 384-388.

Which of the following teeth is most susceptible to vertical root fracture?

- a. Mandibular second premolar
- b. Mandibular central incisor
- c. Maxillary 1st molar
- d. Mandibular 2nd molar

Answer: d

The mandibular 2nd molar is most susceptible to vertical root fracture. The fracture may be related to post-placement or the restoration, but the main etiologic factor seems to be overzealous application of condensation forces when obturating an underprepared or overprepared canal. Prevention involves properly preparing the canal and use of balanced pressure during obturation. Use of finger spreaders and pluggers which are more flexible than hand spreaders is recommended. Indications of a vertical root fracture include a feeling of discomfort or pain or a cracking sound during obturation. A sudden decrease of resistance to pressure of the spreader or a condenser during obturation may also occur. Blood in the canal is also a sign. Vertical root fractures many times appear up to a year after obturation of the root canal. Narrow periodontal pocketing and/or a sinus tract are indicators of the presence of a vertical root fracture. Radiographically you may see a lateral radiolucency extending to the apical portion of the vertical fracture. Exploratory surgery is often necessary to confirm the presence of a fracture. Prognosis is hopeless for the involved root. Treatment is removal of the involved root if a multi-rooted tooth or extraction if it involves a single-rooted tooth.

Weine FS, Pasiewicz RA, Rice RT. Canal configuration of the mandibular second molar using a clinically oriented in vitro method. J Endodon 1988; 14: 207-13.

Textbook: Principles and Practice of Endodontics. Walton and Torabinejad. 1989. Pages 227-8, 307.

Which of the following is/are part of the formula for Roth Sealer?

1. Zinc oxide
 2. Staybelite resin
 3. Barium sulfate
 4. Bismuth subcarbonate
 5. Calcium hydroxide
-
- a) 1,2,5
 - b) 1,2,3,4
 - c) All of the above
 - d) 5

Answer: b

Zinc oxide-eugenol sealers:

- 1) history of successful use over an extended period of time
- 2) will resorb if extruded into the periradicular tissues
- 3) exhibit a slow setting time, shrinkage on setting, and solubility
- 4) can stain tooth structure
- 5) have antimicrobial activity.

Formula for Zinc Oxide-Eugenol Root Canal Sealer

Zinc oxide	42 parts
Staybelite resin (hydrogenated rosin glycerol ester)	27 parts
Bismuth subcarbonate	15 parts
Barium sulfate	15 parts
Sodium borate, anhydrous	1 parts

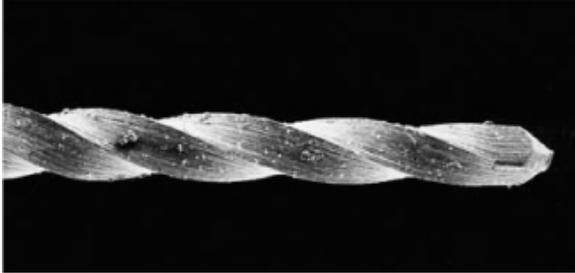
Liquid eugenol

The reaction between zinc and eugenol is of an ionic nature.

Barium Sulfate: provides radiopacity during x-ray examination.

Staybelite resin acts as an accelerator.

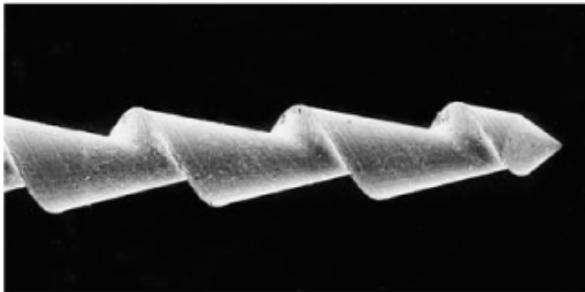
Anhydrous sodium tetraborate - retard the setting time



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K-file with a blunt tip

K-type instruments are useful for penetrating and enlarging root canals. The K-file and K-reamer are the oldest useful instruments for cutting and machining dentin



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H Type: Hedström file #45

An H-type instrument has spiral edges arranged to allow cutting only during a pulling stroke. An example is a Hedstrom file. H-type instruments are better for cutting than a K-type instrument because it has a more positive rake angle and a blade with a cutting rather than a scraping angle. Bending a Hedström file results in points of greater stress concentration than occurs with K-type instruments. These concentration points can lead to the propagation of cracks and fatigue failure. Clinically, fatigue happens without any external physical signs of stress, such as the flute changes seen in K-type instruments.

H-files cut the canal wall when pulled or rotated clockwise; the file is relatively ineffective when pushed or rotated counterclockwise. Because the H-file generally has sharper edges than the K-file, it has a tendency to screw into the canal during rotation, particularly if the instrument's blades are nearly parallel. Awareness of screwing-in forces is important for avoiding instrument failure.



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K-Flex file #35. This file resembles a classic K-file with its twisted pattern. The **cross section** of the blank is **rhomboid**, giving the instrument a small and a large diameter that can be clearly seen. Note the untwisted tip

Cohen S., Hargreaves K., Pathways of the Pulp, 9th Edition, Mosby, 2006 p. 239-243

Match:

- | | |
|-------------------------|--|
| 1. crown down technique | _a. working lengths decrease in a stepwise manner with increasing instrument size |
| 2. step back technique | _b. passively inserts a large instrument into the canal, smaller instrument then is used to progress deeper into the canal |

Answer:

1. b
2. a

The number of sides and the number of spirals determine whether the instrument is best suited for filing or reaming. Generally, a three-sided configuration with fewer spirals is used for reaming; a three- or four-sided configuration with more spirals is used for filing.

Basic cleaning and shaping strategies for root canal preparation can be categorized as crown-down, step-back, apical widening, and hybrid techniques.

crown-down approach, the clinician passively inserts a large instrument into the canal up to a depth that allows easy progress. The next smaller instrument then is used to progress deeper into the canal; the third instrument follows, and this process continues until the terminus is reached. Both hand and rotary instruments may be used in a crown-down manner.

In the step-back approach, working lengths decrease in a stepwise manner with increasing instrument size. This prevents less flexible instruments from creating ledges in apical curves while producing a taper for ease of obturation.

Most rotary techniques require a crown-down approach to minimize torsional loads³⁶ and to reduce the risk of instrument fracture. Used sequentially, the crown-down technique can help to enlarge canals further. All basic techniques described so far may be combined into a hybrid technique to eliminate or reduce the shortcomings of individual instruments.

Cohen S., Hargreaves K., Pathways of the Pulp, 9th Edition, Mosby, 2006 p. 327-330

Which of the following are organisms most often cultivated from endodontic infections?

1. *Fusobacterium nucleatum*
 2. *Streptococcus* sp.
 3. *Bacteroides* sp.*
 4. *Prevotella intermedia*
 5. *Porphyromonas endodontalis*
-
- a) 1,2,3,4
 - b) 1,2
 - c) 1
 - d) All of the above
-

Answer: d

Bacteria from the Root Canals of Teeth with Apical Rarefactions

BACTERIA	PERCENTAGE OF INCIDENCE
<i>Fusobacterium nucleatum</i>	48
<i>Streptococcus</i> sp.	40
<i>Bacteroides</i> sp.*	35
<i>Prevotella intermedia</i>	34
<i>Peptostreptococcus micros</i>	34
<i>Eubacterium alactolyticum</i>	34
<i>Peptostreptococcus anaerobius</i>	31
<i>Lactobacillus</i> sp.	32
<i>Eubacterium lentum</i>	31
<i>Fusobacterium</i> sp.	29
<i>Campylobacter</i> sp.	25
<i>Peptostreptococcus</i> sp.	15
<i>Actinomyces</i> sp.	15

<i>Eubacterium timidum</i>	11
<i>Capnocytophaga ochracea</i>	11
<i>Eubacterium brachy</i>	9
<i>Selenomonas sputigena</i>	9
<i>Veillonella parvula</i>	9
<i>Porphyromonas endodontalis</i>	9
<i>Prevotella buccae</i>	9
<i>Prevotella oralis</i>	8
<i>Propionibacterium propionicum</i>	8
<i>Prevotella denticola</i>	6
<i>Prevotella loescheii</i>	6
<i>Eubacterium nodatum</i>	6
*Nonpigmenting species Other species isolated in low incidence: <i>Porphyromonas gingivalis</i> , <i>Bacteroides ureolyticus</i> , <i>Bacteroides gracilis</i> , <i>Lactobacillus minutus</i> , <i>Lactobacillus catenaforme</i> , <i>Enterococcus faecalis</i> , <i>Peptostreptococcus prevotii</i> , <i>Eikenella corrodens</i> , and <i>Enterobacter agglomerans</i> .	

Cohen S., Hargreaves K., Pathways of the Pulp, 9th Edition, Mosby, 2006 p. 582

Sundqvist: Taxonomy, ecology, and pathogenicity of the root canal, *Oral Surg* 78:522, 1994.)

In the management of persistent apical periodontitis, the following are indications for a surgical approach:

- a. A long post cemented in the canal
- b. Nonnegotiable ledges and canal blockages
- c. Hard cement filling materials
- d. Biopsy indicated
- e. All of the above

Answer: e. All of the above.

Nonsurgical retreatment is the first approach in the management of persistent apical periodontitis; however, when nonsurgical treatment is unlikely to improve on the previous result, a surgical approach must be considered. However, “even when surgical treatment is the likely definitive approach, nonsurgical therapy before the procedure may be recommended to help reduce the number of microorganisms in the root canal system.” (Pathways of the pulp, p. 727) Contraindications to nonsurgical treatment first would include situations where this would increase the risk and cost involved such as the need to remove a recently restored bridge abutment to gain access for the nonsurgical retreatment.

Cohen and Hargreaves, Pathways of the Pulp, 9th ed., Copyright © 2006, Mosby, Inc.
p. 726-727

Approximately 75% of teeth have canal aberrations in the:

- a. Apical 1 mm of the root
- b. Apical 3 mm of the root
- c. Middle 1/3 of the root
- d. Furcation area
- e. None of the above

Answer: b. Apical 3 mm of the root

Two main principles dictate the extent of the root-end resection: the etiology of the disease must be addressed which includes removal of diseased tissue and reduction of an apically fenestrated root and creation of enough room for inspection and management of the root end. Resection of the apical 3 mm. of most roots accomplishes this goal. This may be modified as needed to accommodate roots with an isthmus area such as molars with MB1 and MB2 canals.

Cohen and Hargreaves, Pathways of the Pulp, 9th ed., Copyright © 2006, Mosby, Inc. p. 726-727

Root-end cavity preparation can best be accomplished with which of the following?

- a. Electric powered straight nose-cone with a #4 round bur
- b. High speed hand piece with water spray adjusted for a fine mist
- c. Ultrasonic device set at high-power
- d. Ultrasonic device set at low-power

Answer: d. An ultrasonic device set at low-power will lessen the chances of root fracture. The device should also have an irrigation port to ensure adequate irrigation to prevent an extreme temperature increase in the periradicular tissues. Standard hand-pieces do not allow adequate access because of their size. Also, any handpiece used during a surgical procedure should have rear air exhaust. Ultrasonic devices set on high have been implicated with a greater percentage of root fractures.

Cohen, Pathways of the Pulp, 9th ed. p. 755-756,

The angle of resection in a root-end resection is:

- a. Determined by the result of methylene blue staining.
- b. Perpendicular or near perpendicular
- c. 45 degrees facial

d. Cone shaped

Answer: b. Perpendicular or near perpendicular

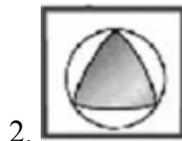
According to Cohen, “enhanced magnification and illumination techniques have eliminated the need to create a beveled root surface in most cases” Cohen further states that anatomic parameters such as the need for elimination of the majority of apical ramifications in that region of the tooth, the desirable results of decreasing exposed dentinal tubules and the need to distribute forces dictate a horizontal preparation.

Cohen, Pathways of the Pulp, 9th ed. p. 752-756

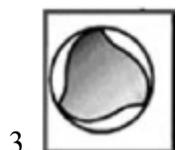
Match:



a. K3



b. RaCe (*reamer with alternating cutting edges*)



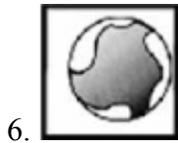
c. Hero



d. Pro taper



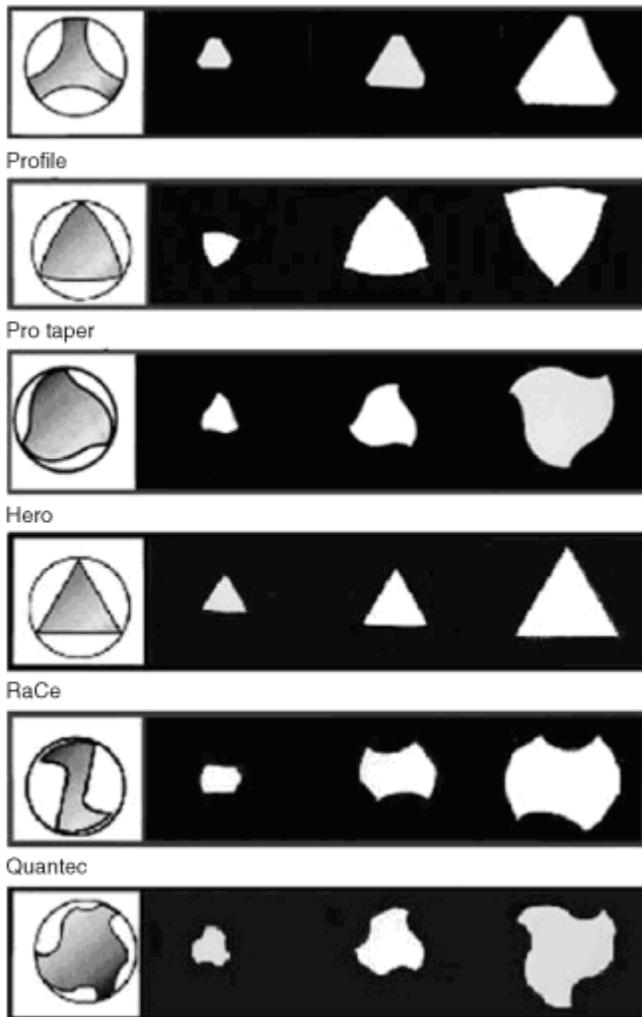
e. Profile



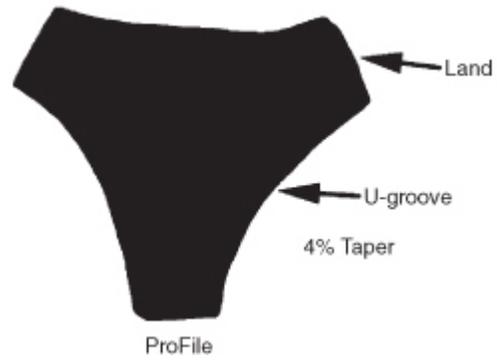
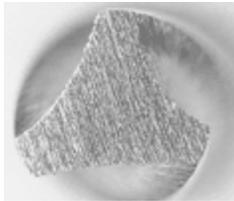
f. Quantec

Answer:

1. e
2. d
3. c
4. b
5. f
6. a

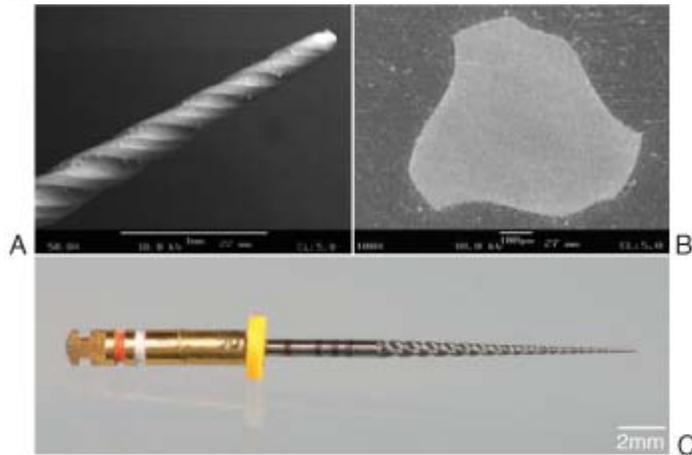


Cross-sectional design (*left*) with the actual cross-sectional shape at different levels on the working surface, at 1 mm, 6 mm, and 14 mm from the file tip (*right*).



ProFile: U-shaped cross-section

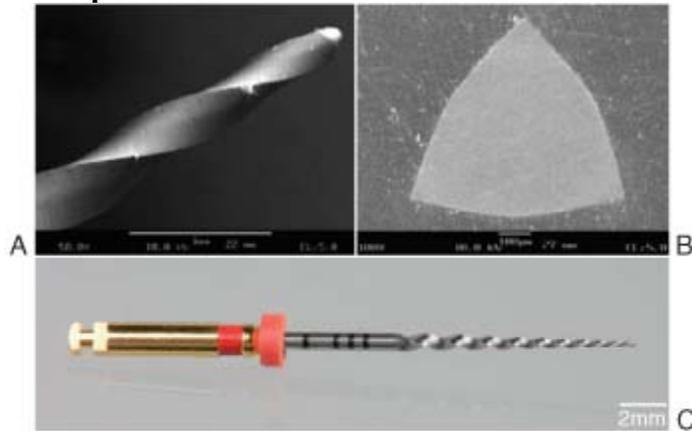
K-3



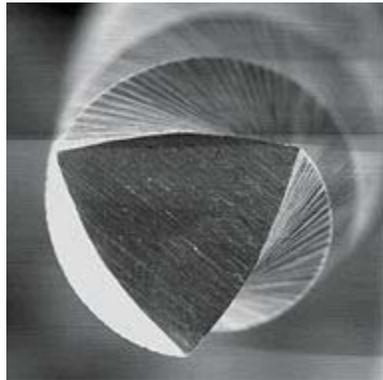
No. of instruments/set	Tip sizes	Size increments	r.p.m. (recommended)	Lengths
27	15-45 with .02 taper; 15-60 with .04 and .06 taper	5	300 to 350, minimal axial force	21, 25, 30 mm

the K3 instrument has three asymmetric flutes separated by lands. a slightly positive rake angle for greater cutting efficiency, wide radial lands, and a peripheral blade relief for reduced friction. Unlike the Quantec, a two-flute file, the K3 features a third radial land to help prevent screwing in.

Pro-taper

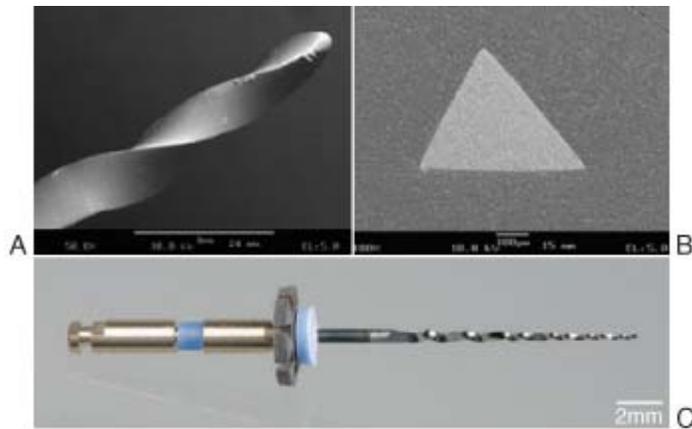


No. of instruments/set	Tip sizes	Size increments	r.p.m. (recommended)	Lengths
6 (3 shaping files; SX, S1, S2; 3 finishing files; F1, F2, F3)	19-30	Vary along the working part of an individual instrument	150 to 350 minimal axial force, low to medium torque to fracture, varying working torque	19, 21, 25 mm



Pro-taper

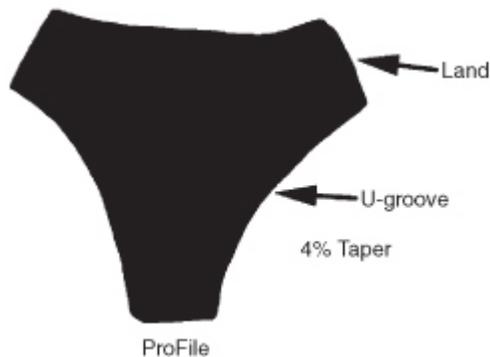
RaCe



No. of instruments/ set	Tip sizes	Size increments	r.p.m. (recommended)	Lengths
15	15-60 (.02)	5 and 10	Up to 600,	19,
	25-35 (.04) 30, 40 (.06) 35 (.08) 40 (.10)	Varying tapers	Minimal axial force	25 mm

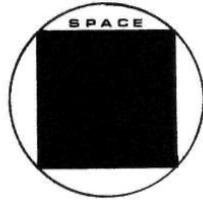
RaCe (*reamer with alternating cutting edges*) twisted areas alternating with straight areas reduces the tendency to screw into the root canal. Cross sections are triangular or square for #.02 instruments with size #15 and #20 tips.

The **Quantec** instrument has double helical, asymmetric flutes. The Quantec also has positive cutting blades on the working portion. The lands of the instrument are said to enhance the instrument's strength..



cross section of **ProFile** showing the triple helix configuration. Note the symmetric U-grooves and the three lands.

Match the file with the appropriate cross section:



1. square

a. K flex



2. triangle

b. K-files



3. rhombus

c. Flexo files



4. round

d. Hedstrom

5. round

e. Barbed broaches

Answer:

1. b
2. c
3. a
4. d
5. e

K flex- rhombus cross section
K- files- square cross section
Flexo-files-triangular cross section
Hedstrom- round cross section

Flexofiles from the Maillefer company, K Files and K Flex from the Kerr company Flexofiles have a triangular crosssection, K Files a square cross-section, and K-Flex instruments a rhombus cross-section from size 15 to size 40. For each group, 10 files from size 15 to size 40 were compared according to ANSI/ADA specification #28 for bending moment evaluation. There was a statistical difference between the three groups: the square cross-section K files presented a larger bending moment than the rhombus cross-section K Flex, which presented a higher bending moment than the triangular cross-section Flexofiles.

A **Hedstrom** file is a tapered steel wire, **round** in cross section, whose flutes are cut in by a machine process. As the name implies, it is a file and thus the working action is on the withdrawal.

The **K-type** file is a tapered steel wire, **square or triangular** in cross section, which has been grasped at the very tip of the wire and twisted. The action is to file or on withdrawal. This file can also be used in a reaming action by placing it in the canal to the first unforced contact, rotating a quarter turn clockwise and then withdrawing
A **broach** is a tapered steel wire, **round** in cross section, into which cuts have been made in the working end. These cuts create barbs, which flare from the shaft of the wire in an outward direction.

References:

1. Cohen S., Hargreaves K., Pathways of the Pulp, 9th Edition, Mosby, 2006 p. 301-315
2. Camps JJ, Pertot WJ. Relationship between file size and stiffness of stainless steel instruments. Endod Dent Traumatol 1994; 10: 260-263.

A patient presents for a root end procedure on tooth #9. Of the flap designs listed which is generally contraindicated?

- A. Semilunar flap
- B. Full mucoperiosteal flap
- C. Submarginal triangular and rectangular flap
- D. Oxsenbein-Leubke flap
- E. All of the above
- F. None of the above

Answer is: A

This half moon shaped flap is raised with a curved horizontal incision in the mucosa or attached gingival with the concavity towards the apex. Although it's simple and does not impinge on the surrounding tissue, the disadvantages outweigh its advantages. Disadvantages include.....

1. Limited access and visibility
2. Tearing of corners of incision
3. If lesion is bigger than anticipated then incision lies over bony defect.
4. Extent is also limited by attachments (i.e.frenum)

Submarginal triangular and rectangular flap (Oxsenbein-Leubke) requires at least 4mm of attached gingival and a healthy periodontium. It is raised by a scalloped incision in the attached gingival with one or two vertical incisions. Less risk of incising over bony defects and no post surgical recession of gingival. Its disadvantages include hemorrhage from the cut margins and scarring. Access and visibility is better than semilunar flap but not as good as full mucoperiosteal flap.

Full Mucoperiosteal flap allows maximal access and visibility. It is raised from the gingival sulcus (elevating gingival crest and interdental gingival). This wide outline of the flap precludes any incisions over bony defects and allows various periodontal procedures including curettage, root planning and bone re-shaping. A large flap may be difficult to reposition, suture and make alterations. Post surgical gingival recession is also a possibility.

References:

Cohen, S, Hargreaves, K (2006) Pathways of the Pulp, 9th edition, Mosby Inc, pp744-746.

Which of the following decrease with age in the dental pulp?

- A. Number of collagen fibers
- B. Number of reticulin fibers
- C. The size of the pulp

- D. Calcifications within the pulp
- E. A & B
- F. B & C
- G. A & C
- H. C & D

Answer is...F

As the pulp ages there is a decrease in reticulin fibers (the pulp becomes less cellular and more fibrous). The size of the pulp also decreases because of the continued deposition of dentin.

As the pulp ages there is an increase in the number of collagen fibers and calcifications within the pulp (called denticles or pulp stones). Pulp stones are associated with chronic pulpal disease from advanced carious lesions or large restorations.

The pulp contains both myelinated and unmyelinated nerve fibers. They are afferent and sympathetic. The myelinated fibers are sensory and unmyelinated fibers are motor.

References:

Stock, C et al. (2004) Endodontics, 3rd edition, Mosby Inc, pp 99-103.

The absence of which layer of dentin predisposes it to internal resorption by cells present in the pulp?

- A. Mantle dentin
- B. Circumpulpal dentin
- C. Predentin
- D. Secondary dentin
- E. Tertiary dentin

The answer is...C

Immediately adjacent to the odontoblast layer in the pulp. 10-47µm of the dentin matrix remain unmineralized. If this unmineralized layer of dentin is lost (e.g. due to trauma or infectious process) it predisposes the dentin to internal resorption by odontoclasts.

Mantle dentin is first formed dentin which is laid before odontoblast layer gets organized. Hence the pattern of deposition and size of collagen fibers is different from circumpulpal dentin.

Circumpulpal dentin represents most of the dentin which is formed

Secondary dentin forms after eruption of a tooth and throughout life resulting in a gradual but asymmetric reduction in pulp size.

Tertiary dentin or reparative dentin is an irregular and disorganized layer of dentin laid down in response to any injurious/irritant stimuli.

References:

Cohen, S, Hargreaves, K (2006) Pathways of the Pulp, 9th edition, Mosby Inc, pp484-485.

Which of the following statements regarding the management of an avulsed tooth are true?

- A. After 60 minutes of dry storage of an avulsed tooth, few periodontal ligament cells survive.
- B. The storage of an avulsed tooth in tap water is as bad as dry storage
- C. Saliva is hypotonic and can allow storage of the tooth up to 2 hours
- D. Milk has a maximum storage time of up to 6 hours
- E. Teeth with complete root development should be treated endodontically as soon as possible even if replanted within 30 minutes.
- F. Teeth with incomplete root development and replanted within 30 minutes may not require endodontic treatment
- G. All of the above are true

The answer is.....G

Five factors that are critical to the management of traumatic avulsion injuries to teeth:

Time: Time interval is major factor in maintenance of ligament viability and subsequent root resorption. Teeth replanted within 30 minutes have been reported to exhibit very little resorption, whereas most of the teeth replanted after 2 hours show a lot of external resorption.

Storage media: If the tooth cannot be immediately replanted, the proper storage of the tooth can favorably influence the viability of PDL cells. Milk is considered best for this purpose because of its near neutral pH (6.5-6.8) and osmolality, conducive for the survival of cells.

Tooth socket: should not be damaged by curettage or forceful replantation

Splint stabilization: a splint that allows the physiologic movement is placed for a maximum of 2 weeks. This time period allows for the initial reattachment of the periodontal ligament fibers.

Root surface: should not be scraped, dried, or manipulated with caustic chemicals.

References:

Manfrin TM, et al. Analysis of procedures used in tooth avulsion by 100 dental Surgeons. Dent Traumatol. 2007 Aug;23 (4): 203-210.

Cohen, S, Hargreaves, K (2006) Pathways of the Pulp, 9th edition, Mosby Inc, Pp 211-213.

Which of the following are correct regarding orthograde retreatment?

- A. Gates-Glidden burs are indicated to remove gutta percha in the coronal 1/3 over heated instruments because they are faster and improve access.
 - B. 2.6% sodium hypochlorite is an appropriate choice for irrigation.
 - C. Xylol can be used to dissolve gutta percha if chloroform is not available.
 - D. EDTA can be used as the final irrigant since its cleaning activity makes it easier to adapt gutta percha and sealer to the canal walls.
 - E. Hydrogen peroxide is as effective as sodium hypochlorite as an irrigant because it releases oxygen and kills anaerobic microorganisms.
- a. All of the above.
 - b. a, c, and e only.
 - c. b, c, and d only.
 - d. b and d only
 - e. a, b, and c only

Answer: e. a, b and c only.

A crown-down technique is indicated for orthograde (nonsurgical) retreatment. This allows for better visualization of materials in the canal and improved access for instrumentation. Gates-Glidden burs are indicated in the coronal 1/3 as most canals are relatively straight in this region, they are time efficient, and improve access relative to heated instruments which only remove gutta percha and do not reshape canal walls.

Sodium hypochlorite is the irrigant of choice. It is acceptable to use at 1.0%, 2.6%, and 5.25%; some manufacturers are producing this material at a concentration of 6.0% which is acceptable as well.

Xylol is an acceptable alternative to chloroform, though not as effective. Other solvents to try include halothane, benzene, carbon disulfide and essential oils.

EDTA should never be used as the final irrigant; while it does dissolve the smear layer and help cleanse canal walls, it will remain active in the canal system for 5 days and continue to demineralize tooth structure if a subsequent sodium hypochlorite rinse is not performed.

While hydrogen peroxide does eradicate anaerobes, it is not as effective as sodium hypochlorite in terms of dissolving necrotic tissue. Again, sodium hypochlorite is the irrigant of choice.

Reference: Walton RE, Torabinejad M. *Principles and practice of endodontics*, 3rd Ed. W.B. Saunders Co. 2002. pp. 218-220, 351-360.

Which of the following is the most critical step in root canal therapy?

- A. Cleaning and shaping.
- B. Obturation.
- C. A hermetic apical seal.
- D. A hermetic coronal seal.
- E. C and D.

Answer: A. Cleaning and shaping.

Historically, many authors have written that obturation is the most important part of root canal therapy. Recent studies have shown that achieving adequate chemomechanical debridement is paramount. The most common cause of root canal failure is inadequately disinfected canal systems. A rubber dam is always indicated during root canal therapy. Even if a superior obturation is achieved, all dental work leaks on a microscopic level and residual microorganisms will eventually cause failure of the endodontic treatment rendered.

A coronal seal has emerged as being more important than the apical seal for long term success as a failed coronal seal provides easier access for microbial invasion of the canal system relative to the failed apical seal in most cases. Even in cases where the endodontic therapy is questionable, a good coronal restoration has been shown to improve the overall result.

Reference: Walton RE, Torabinejad M. *Principles and practice of endodontics*, 3rd Ed. W.B. Saunders Co. 2002. pp. 218-220, 351-360.

An 8 year old patient presents with a complex crown fracture of tooth #9. After careful clinical and radiographic evaluation, you decide apexogenesis is indicated as full apical closure has not yet been obtained. After removing some obviously contaminated coronal pulp tissue, you were not able to control hemorrhage with cotton pellets and pressure. Which of the following should be your next step?

- A. Apply Hemodent via a cotton pellet.
- B. Remove more pulp tissue.
- C. Place dry calcium hydroxide and close the tooth.

- D. Irrigate with sodium hypochlorite and try again with cotton pellets.
- E. Inject 2% lidocaine with 1/50,000 epinephrine directly into the pulp.

Answer: B. Remove more pulp tissue.

If hemostasis is not achieved, this indicates inflamed (and possibly contaminated) pulp tissue is still present. In the case above, inflammation has infiltrated the pulp beyond the point where amputation was performed. Using a hemostatic agent without removing more pulp tissue will likely compromise the outcome as inflammation will remain in the root canal system. The same applies to the use of calcium hydroxide, sodium hypochlorite and a vasoconstrictor in this situation. When performing a pulpotomy, a rubber dam is always indicated and contamination of the remaining pulp should be reduced as much as possible.

Many practitioners use formocresol to control hemorrhage in primary teeth during pulpotomy procedures. While effective in this setting, its use in permanent teeth has been associated with eventual failure. Formocresol should not be used in young permanent teeth.

References:

- Walton RE, Torabinejad M. *Principles and practice of endodontics*, 3rd Ed. W.B. Saunders Co. 2002. pp. 218-220, 351-360.
- Pinkham JR. *Pediatric dentistry: Infancy through adolescence*, 3rd Ed. W.B. Saunders Co. 1999. pp. 347-349, 527-529.

Which of the following are viable treatment options for a necrotic permanent tooth with an immature apex? Select all that apply.

- A. Cvek pulpotomy.
- B. Apexogenesis.
- C. Apexification.
- D. Conventional root canal therapy.
- E. Immediate apical barrier with MTA.
- F. Extraction.

Answer: C. Apexification.
E. Immediate apical barrier with MTA.
F. Extraction.

A Cvek (or shallow) pulpotomy is removal of minimal coronal pulp tissue after a relatively clean exposure (usually traumatically). It is a form of vital pulp therapy and is not indicated in necrotic teeth.

Similarly, apexogenesis is indicated in vital teeth. The goal of therapy is to preserve vital (and healthy) radicular pulp tissue and promote physiologic closure of the root end. It is contraindicated in teeth with signs of pulp necrosis (percussion sensitivity, periapical lesions, sinus tracts, etc.).

Conventional root canal therapy is not indicated in these teeth as no apical stop is present and condensation of gutta percha is not possible.

Apexification involves complete pulpal debridement and placement of calcium hydroxide to encourage the formation of an apical stop. The canal dressing is changed every few months to “freshen” its potency. Once an apical stop is formed (which tends to be spongy histologically), conventional obturation is indicated. Historically calcium hydroxide has been the material of choice during treatment.

The immediate apical barrier technique differs from apexification in that obturation can be performed immediately. The technique is most commonly done using a 2mm calcium hydroxide plug or an MTA barrier. It is necessary to allow the MTA to set prior to obturation (at least 4 hours). Another material used is tricalcium phosphate. This technique is advocated as re-entry and replacement of materials is not required. It also eliminates issues associated with patients being lost to follow-up. The key difference between immediate apical barrier treatment and apexification is that the former allows obturation to occur immediately (or after the MTA has set), while the latter requires multiple visits over the course of months to allow the development of an apical stop.

Extraction is the treatment of choice for nonrestorable teeth. Replacement options should be considered carefully prior to the surgical appointment.

References:

- Rafter M. Apexification: a review. *Dental Traumatology*. 2005; 21: 1-8.
- Walton RE, Torabinejad M. *Principles and practice of endodontics*, 3rd Ed. W.B. Saunders Co. 2002. pp. 218-220, 351-360.
- Coviello J, Brillinat JD. A preliminary study on the use of tricalcium phosphate as an apical barrier. *J Endodontics*. 1979. 5(1): 6-13.
- Weisenseel JA Jr, Hicks ML, Pelleu GB Jr. Calcium hydroxide as an apical barrier. *J Endodontics*. 1987. 13(1): 1-5.

Matching:

- a. Method of inducing a calcified apical barrier or continued apical development of an incompletely formed root in which the pulp is necrotic.
- b. Physiological development and formation of the root end. Used to describe vital pulp therapy performed to permit the continuation of this process.
- c. A pulpal response to trauma characterized by rapid deposition of hard tissue within the canal space. Radiographically the canal space may appear obliterated.
- d. Injury to supporting tissues resulting in abnormal loosening of a tooth or teeth without displacement.

- 1 Apexogenesis
 - 2 Apexification
 - 3 Subluxation
 - 4 Calcific metamorphosis
-

Answer: **1b , 2a, 3d, 4c**

Ref: Cohen S. and Hargreaves, K.: Pathways of the Pulp, 9th edition, 2006

Apexogenesis: p.864-866

Apexification: p.621-622

Subluxation p.630

Calcific metamorphosis p.299

Radiographic Technique: Paralleling radiographic technique is recommended over the bisecting angle technique because:

1. Parallel radiographs show less distortion and minimal enlargement
2. Are more accurate
3. Decrease the chance of the zygomatic process overlapping the roots in maxillary molar teeth .
4. Initial canal measurements and obturation measurements can be reliably made.

- a. 1,2
 - b. 2,4
 - c. 1,3,4
 - d. All the above
-

Answer: **d.**

Ref: Text: Practical Endodontics, A Clinical Atlas, Dr. Besner et al., 1994, p.56-57

Explanation: Incorrect film placement is the most common error in radiography and can lead to an improper diagnosis and missed endodontic measurements. This is followed in order of occurrence by cone cutting, processing errors, and incorrect vertical and/or horizontal angulation.

Principles of Root Canal Preparation: Define the following:

1. Convenience form
2. Resistance form
3. Retention form

- a. straight line access from incisal or occlusal to the apex. Objective is to prevent overmanipulation or ellipticizing of apical area
- b. preserve integrity of the natural apical constriction. This helps prevent overextension of the material after condensation.

- c. to provide 2mm of near parallel walls at the apical end of the root canal preparation to provide tugback or retention of the trial or master cone. The root canal must be tapered from the apical collar to the access cavity to ensure that the retention comes from the apical end.
-

Answer: **1a, 2b, 3c**

Ref: Besner et al: Practical Endodontics, A Clinical Atlas, 1994, p.132

Matching: How should one treat the following:

1. Complicated crown-root fractures (involving pulp)
 2. Crown fracture (enamel only)
 3. Alveolar fractures
 4. Horizontal root fracture
- a. Reposition coronal fragments as soon as possible: stabilize with splint 3-4 weeks.
 - b. Bone segment containing the involved teeth is mobile, 4 radiographs, baseline vitality tests, reposition bony fracture, suture soft tissues prn, stabilize fragments with splint 3-4 weeks.
 - c. One radiograph, evaluate size of pulp chamber and root development, baseline vitality tests, remove sharp edges, restore with GI cement or permanent restoration, recall at 6-8 weeks and 1 year.
 - d. 4 radiographs, baseline vitality tests, expose subgingival fracture site, extract loose segment, pulpal protection: CaOH or GI, crown lengthening may be needed, recall at 6-8 weeks and one year.
If open root: pulp cap, or pulpotomy, or wait for completion of root formation
If root is closed: perform RCT
-

Answer: **4a, 3b, 2c, 1d**

Ref: Cohen and Hargreaves: Pathways of the Pulp, 9th edition, 2006

1. and 4. p.626
2. p.616
3. p.614-615

PERIODONTICS

What are considered risk factors for periodontitis? Select all that apply:

- a. kidney disease
- b. iatrogenic
- c. HIV infection
- d. Lung cancer
- e. Diabetes
- f. Calculus
- g. Smoking
- h. Glaucoma

Answer: b, c, e, f, g

A risk factor is an exposure that increases probability that disease will occur. There are local factors and systemic factors.

Local:

- Calculus
- Anatomic factors
- Restorative factors
- Iatrogenic factors

Systemic:

- Diabetes
- HIV infection
- Smoking
- Genetics

Select all the features that characterize a NUG infection from a NUP infection:

- a. punched out papillae
- b. low CD4+ count
- c. fetid breath

- d. HIV infection
- e. Deep bony pain (hallmark sign)
- f. Gingival bleeding (not spontaneous)

Answer: a, c, f

Signs and symptoms of NUG include

- P**ain,
- I**nterdental papillae ulceration and

Gingival.

Signs and symptoms of NUP include:

Severe and rapid attachment loss

Low CD4 cell count

Extension of NUG

Deep pain, spontaneous gingival bleeding, soft tissue necrosis and exposed osseous tissues.

Carranza's Clinical Periodontology Ninth edition

When does revascularization take place?

- a. 0-2 days
- b. 2-7 days
- c. 7-11 days
- d. 14 days
- e. 21 days

Answer: b

Success of the graft depends on survival of the connective tissue. Graft is initially maintained by a diffusion of fluid from the host bed, adjacent gingiva and alveolar mucosa.

0-2 days:	plasmatic circulation
2-7 days:	revascularization
7-11 days:	organic union
14 days:	re-epithelialization
21 days:	tissue keratinization

Carranza's Clinical Periodontology, Ninth Edition; Periodontal Plastic and Esthetic Surgery.

Which fibers are most resistant to periodontitis?

- a. Transeptal fibers
- b. Intergingival
- c. Circular
- d. Dentogingival

Answer: A

Gingival Fibers – to provide support and structure

Circular – courses through the connective tissue of the marginal and interdental gingiva and encircles the tooth in a ringlike fashion

Gingivodental – provide gingival support

Periostogingival – attach gingiva to bone

Transseptal – located interproximally, they form horizontal bundles that extend between cementum of approximating teeth

Periodontal Fibers – to provide attachment, distribute and absorb forces

Alveolar Crestal

Horizontal

Oblique

Apical

Carranza's Clinical Periodontology 9th Ed, pg 357-358 and 26-29

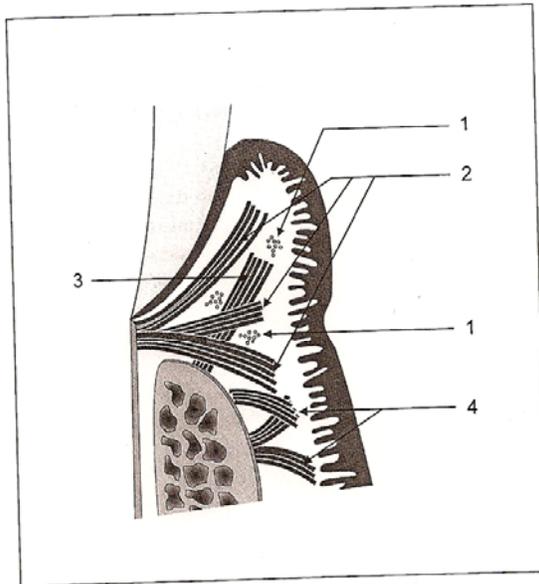


Fig 3-17a Gingival collagen fiber groups in vertical section: (1) circular fibers, (2) dentogingival fibers, (3) alveologingival fibers, and (4) periostogingival fibers.

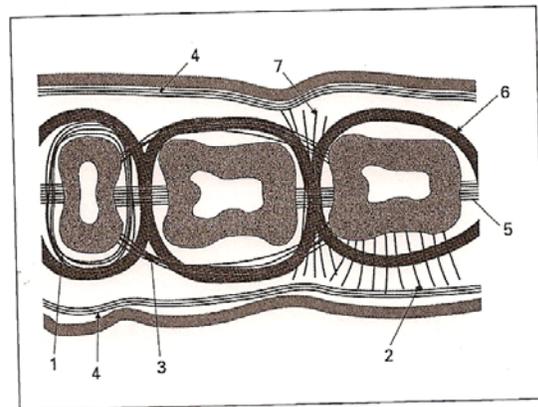


Fig 3-17b Gingival collagen fiber groups in horizontal section: (1) circular fibers, (2) dentogingival fibers, (3) intercircular fibers, (4) intergingival fibers, (5) transseptal fibers, (6) transgingival fibers, and (7) interpapillary fibers.

Match the following enzymes with their action within the periodontal tissues. Only one answer per item.

___ collagenase

___ hyaluronidase

___ chondroitinase

___ proteases

a. Hydrolyzes chroitin sulfate.

b. Contributes to the breakdown of non-collagenous proteins and increases capillary permeability.

c. Depolymerizes collagen fibers and fibrils.

d. Hydrolyzes hyaluronic acid and can increase tissue permeability.

Answer:

 c collagenase

 d hyaluronidase

 a chondroitinase

 b proteases

Peter F. Fedi Jr. The Periodontal Syllabus, 2nd Edition page 17.

The hallmark of inflammatory periodontal disease is connective tissue destruction. PMN and macrophages are responsible for matrix degradation. This occurs via phagocytosis or by MMP release. Collagenases include MMP-1 and MMP-8. The PMN secrete large quantities of these enzymes during acute inflammation. They can cause extensive destruction in a short period of time. Higher levels of MMP-8 have been identified in individuals with chronic and localized aggressive periodontitis. (Carranza's Clinical Periodontology, Tenth Ed 2006, page 87)

Collagen degradation requires enzymes to breakdown the molecules. These enzymes called collagenases initiate the breakdown by cleaving peptide bonds in the collagen. The result is the release of smaller fragments which become denatured and further degraded by proteinases. Collagens may also be ingested by macrophages and fibroblasts and hydrolyzed by lysosomal enzymes. MMP-1 (fibroblast-type) and MMP-8 (PMN-type) collagenases are considered interstitial collagenases. Their substrates include collagen types I, II, III, IV, VIII, X and gelatin. The fibroblast enzyme hydrolyzes type III fibers faster than type I, and the PMN enzyme hydrolyzes type I faster. (Wilson and Kornman Fundamentals of Periodontics, Second Ed, pages 72-74)

Which of the following are indications for performing an ostectomy?

- a. A tooth with a short root trunk, moderate bone loss and a one-walled defect.
- b. A tooth with a three-walled defect and moderate bone loss.
- c. A tooth with severe bone loss and a two-walled defect.
- d. A tooth with a one-walled defect, a moderate-length root trunk and moderate bone loss.

1. a and b

2. c and d

3. a, b and c
4. d only

Answer: 4

Carranza's Clinical Periodontology, 10th Ed, 2006. Pages 952-953.

Ostectomy involves the removal of tooth-supporting bone. The technique of ostectomy is best applied to patients with early to moderate bone loss (2-3mm), with moderate-length or long root trunks and one- or two-walled bony defects. If the root trunk is short there is a risk creating an exposure of the furcation. Three-walled bony defects are best treated with bone grafts. If there is already severe bone loss it is not recommended to remove more bone with this procedure. The ultimate goal of osseous surgery is to establish contours that existed physiologically before destruction occurred which will facilitate hygiene and long-term maintenance.

Which of the following is an advantage of systemic antibiotic use in controlling periodontal disease? You may choose more than one answer.

- a. Improved patient compliance with therapy.
- b. Lower cost of treatment.
- c. Serves as an adjunct for treating aggressive and refractory forms of periodontal disease.
- d. A single antibiotic properly prescribed can inhibit the growth of all microorganisms that cause periodontal disease.

Answer: c

Carranza's Clinical Periodontology, 10th Ed, 2006. Pages 798-801.

The main reason for using systemic antibiotics for treating periodontal disease is to control a periodontal infection that is failing to respond to mechanical methods of treatment and local delivery of chemotherapeutics. Systemic antibiotics serve as an adjunct to treatment and should not be used alone for treatment. An ideal antibiotic for use in the treatment of periodontal disease should be specific for periodontal pathogens, be non-toxic, be substantive, not be used for treatment of other diseases and be inexpensive. This ideal antibiotic does not currently exist. No single antibiotic at concentrations achieved in body fluids inhibits all known periodontal pathogens. Combination therapy with more than one antibiotic may come close to inhibiting all known pathogens in certain perio pockets. Clinical diagnosis and situation determine the need for antibiotic therapy as an adjunct in controlling active periodontal disease. Unresolving disease activity such as, continuing attachment loss, purulent exudate and

continuing periodontal pockets of 5mm or greater and bleed upon probing are indications for periodontal intervention and possible antimicrobial therapy. Also, cases of aggressive and refractory periodontitis may indicate the use of antimicrobial therapy. Antibiotics have been shown to reduce the need for periodontal surgery in patients with chronic periodontitis.

Which of the following are disadvantages of using systemic antibiotics?

- a. Development of superinfections with opportunistic bacteria.
- b. Potential drug interactions.
- c. Increased cost of periodontal therapy.
- d. Reliance on patient taking antibiotics as they are actually prescribed.
- e. All the above.

Answer: e

Carranza's Clinical Periodontology, 10th Ed, 2006. Pages 798-801.

Treatment of the individual patient must be based on the patient's clinical presentation, the nature of the bacteria present and risks versus benefit associated with the treatment. The selection of the correct antimicrobial agent ultimately lies with the clinician. Problems associated with systemic antibiotic treatment include: allergic and anaphylactic reactions, superinfections with opportunistic bacteria, development of resistant bacteria, interactions with other medications, upset stomach, nausea and vomiting. Other problems include the cost of medication and the patient's willingness to comply with the proposed therapy.

What are the goals of GTR?

- A. To GAIN connective tissue attachment.
- B. Periodontal regeneration.
- C. A and B
- D. Neither A nor B

Answer: C.

Guided Tissue Regeneration involves the creation of new cellular attachment and growth vs. removal of diseased tissue or re-positioning of existing healthy tissue.
Lindhe, Clinical Periodontology and Implant Dentistry, 3rd ed., Copyright 1997 p. 523

The use of physical barriers in Guided Tissue Regeneration is to do what?

- A. Retard apical migration of epithelium.
- B. Exclude gingival connective tissue from the healing wound
- C. Both
- D. Neither

Answer: C.

Epithelial cells grow faster than osseous tissue, so a physical barrier is needed to prevent the epithelial tissues from growing into an osseous site before a bone –regeneration technique has a chance to complete.

Lindhe, Clinical Periodontology and Implant Dentistry, 3rd ed., Copyright 1997 p. 523

Which of the following inflammatory cells in periodontitis transform into plasma cells upon secondary exposure to an antigen?

- a. Neutrophils
- b. T-Lymphocytes
- c. B-Lymphocytes
- d. Macrophages
- e. Mast Cells

c. B-Lymphocytes

Monocytes, by convention, are called Macrophages when they exit the blood. This is associated with a longer-term infection. T-Lymphocytes recognize antigens. They are sub-divided into CD4 and CD8 cells. The CD4 ones reversibly bind molecules found on dendritic cells, macrophages and B-cells. They initiate and help the immune responses. CD8 cells are cytotoxic cells involved in controlling intracellular antigens. B-cells have receptors that recognize antigens. These bind tightly, enabling the B-cells to act alone. In addition, they can ingest the antigen and present it to T-cells. Some B-cells differentiate to form plasma cells after antigen exposure. These secrete IgM antibodies, and in the presence of T-cells, they form memory B-cells, which give rise to plasma cells upon secondary exposure to antigen. Mast cells are important in immediate inflammation. These cells have receptors for the production of IgE and IgG antibodies, which can result in activation and secretion of vasoactive substances that can lead to an increase in vascular permeability and dilation (2 signs of anaphylaxis). These cells also have lysosomes, which store inflammatory mediators such as histamine, eosinophil chemotactic factor, heparin, tumor necrosis factor, leukotrienes, and SRS (Slow-reacting substances of anaphylaxis)

Carranza, p. 116-117, Clinical Periodontology 9th ed., copyright © 2002 by W.B. Saunders Co.

Which of the following are true about Lipopolysaccharides in periodontal disease:

- A. Initiates the earliest stage of inflammation
- B. Are released by the destruction of collagen in the tissues
- C. Block the action of antibodies
- D. Follows initial inflammatory changes

“Periodontitis is a bacterially induced chronic inflammatory disease”¹ Bacterial accumulations lead to inflammatory changes in the periodontal tissues. Small-molecular-weight bacterial products initiate the process by entering the tissue which responds. The response leads to an increase in tissue permeability. This, however, allows larger molecular weight bacterial antigens and lipopolysaccharides (LPS) to enter the tissue. LPSs are released from the cell walls of gram-negative bacteria. They activate junctional epithelial cells to produce inflammatory mediators such as IL-1, IL-8, PGE2 and MMPs. The LPSs can also activate the complement cascade via the indirect pathway. Finally, they induce the production of kinins. All of these actions act on blood vessels and endothelial cells to influence individual inflammatory response. These molecules activate host-produced mediators of inflammation and can cause activation of fibroblasts and osteoclasts leading to destruction of the pdl, gingival connective tissues and alveolar bone. It appears that genetic and behavioral differences that influence individual inflammatory response play a large role in determining who will get severe periodontal disease. For example, genes that cause the excess production of IL-1 β have been implicated in the production of periodontal disease. Also, diabetes mellitus and smoking both enhance the inflammatory response to bacterial LPS while ALSO compromising neutrophil action leading to a decreased ability combat infection.

Wilson and Kornmann, Fundamentals of Periodontics, 2nd ed., Copyright 2003 by Quintessence Publishing Co, Inc

Which statements are correct about the Pouch and tunnel graft technique?

1. Intimate contact of donor tissue to recipient side
 2. Used for esthetic cases as ant. Maxillary area
 3. The thickening of the gingival margin after healing is an advantage
 4. Split thickness flap
 5. Full thickness flap
 6. pouch may extend 10 to 12mm apical to the recessed gingival margin and papilla
- a. 1, 2
 - b. 3,4
 - c. 1,2,3,4,6
 - d. 1,2,3,5,6
 - e. 1,2,3,4
-

Answer: **C**

What of the followings is required for the Pouch and tunnel graft technique?

1. Good vestibular depth and gingival thickness
 2. extends 6 to 8mm mesial and distal to the denuded root surface
 3. Subepithelial donor CT
 4. Complete coverage of the donor CT
 5. CT tissue should be place under the pouch
 6. Free gingival graft
- a. 1,2
 - b. 3,4
 - c. 1,2,3,4,5
 - d. All of the above
 - e. 5,6

Answer: **C**

To minimize incisions and reflection of flaps and to provide abundant blood supply to the donor tissue, the placement of subepithelial donor connective tissue into pouches beneath papillary tunnels allows for intimate contact of donor tissue to the recipient site.⁸¹ After positioning the graft, the coronal placement of the recessed gingival margins completely covers the donor tissue. Therefore the esthetic result is excellent. This technique is especially effective for the anterior maxillary area, where vestibular depth is adequate and there is good gingival thickness ([Figure 69-16](#)).

One of the advantages to this technique is the thickening of the gingival margin after healing. The thicker gingival margin is more stable to allow for the possibility of "creeping reattachment" of the margin. The use of small, contoured blades enables the surgeon to incise and split the gingival tissues to create the recipient pouches and tunnels ([Figure 69-17](#)).

page 1022

page 1023

This technique consists of the following steps (see [Figure 69-16](#)):

- *Step 1. Using a #15C or #12D blade, a sulcular incision is made around the teeth adjacent to the recession. This incision separates the junctional epithelium and the connective tissue attachment from the root.*
- *Step 2. Using either a curette or a small blade such as the #15C, a tunnel is created beneath the adjacent buccal papilla, into which the connective tissue is placed.*

- Step 3. A split-thickness pouch is created apical to the papilla, which has been tunneled, and the adjacent radicular surface. This pouch may extend 10 to 12 mm apical to the recessed gingival margin and papilla and 6 to 8 mm mesial and distal to the denuded root surface.
- Step 4. The size of the pouch, which includes the area of the denuded root surface, is measured so that an equivalent size of donor connective tissue can be procured from the palate.
- Step 5. Using sutures, currettes, and elevators, the connective tissue is placed under the pouch and tunnel, with a portion covering the denuded root surface.
- Step 6. The mesial and distal ends of the donor tissue are secured by gut sutures. The gingival margin of the flap is coronally placed and secured by horizontal mattress sutures that extend over the contact of the two adjacent teeth. If the teeth are not in contact, a small amount of composite material may be placed temporarily between the two teeth to allow the placement of the suture over the closed contact.
- Step 7. Other holding sutures are placed through the overlying gingival tissue and donor tissue to the underlying periosteum to secure and stabilize the donor tissue beneath the gingiva.
- Step 8. A periodontal dressing is used to cover the surgical site.

Carranza's *Clinical Periodontology*, 10th ed (2006), p. 1021-1022.

Which of the followings are absorbable sutures?

1. Silk
 2. ePTFE
 3. Nylon
 4. Plain gut
 5. Monocryl
 6. vicryl
- a. 1,2
 - b. 2,3,4
 - c. 4,5,6
 - d. All of the above

Answer: **C**

BOX 64-1 Sutures for Periodontal Flaps

Nonabsorbable (Nonresorbable)

- *Silk: braided*
- *Nylon: monofilament (Ethilon)*

- *ePTFE: monofilament (Gore-Tex)*
- *Polyester: braided (Ethibond)*

Absorbable (Resorbable)

- *Surgical: gut*
- *Plain gut: monofilament (30 days)*
- *Chromic gut: monofilament (45-60 days)*

Synthetic

- *Polyglycolic: braided (16-20 days)*
 - *Vicryl (Ethicon)*
 - *Dexon (Davis & Geck)*
- *Polyglactone: monofilament (90-120 days)*
 - *Monocryl (Ethicon)*
- *Polyglyconate: monofilament (Maxon)*

The most common resorbable sutures are the natural, plain gut and the chromic gut. Both are monofilaments and are processed from purified collagen of either sheep or cattle intestines. The chromic suture is a plain gut suture processed with chromic salts to make it resistant to enzymatic resorption, thereby increasing the resorption time. The synthetic resorbable sutures are also often used.

Carranza's *Clinical Periodontology*, 10th ed (2006), p. 931

Which of the following does not relate to growth factors

1. *Primarily secreted by macrophages, endothelial cells, fibroblasts and platelets*
2. *PDGF, TGF*
3. *IGF, bFGF, BMP*
4. *Used to stimulate healing*
5. *Enamel matrix protein derivative*

- a. *all of the above*
- b. *1,2,3*
- c. *3,4,5*
- d. *1,2,3,4*
- e. *1*

Answer: d

Biologic Mediators

Periodontal regeneration involves the formation of several different tissues; bone, cementum, and periodontal ligament will all be formed.

Biologic mediators have been used to stimulate periodontal wound healing (e.g., promoting migration and proliferation of fibroblasts for periodontal ligament formation) or to promote the differentiation of cells to become osteoblasts, thereby favoring bone formation.⁷⁵

Growth factors are biologic mediators. Growth factors are primarily secreted by macrophages, endothelial cells, fibroblasts, and platelets, include platelet-derived growth factor (PDGF), insulin-like growth factor (IGF), basic fibroblast growth factor (FGF), bone morphogenetic protein (BMP), and transforming growth factor (TGF).

The addition of PDGF, for example, has been shown to enhance bone formation in periodontal osseous defects. In a two-center, prospective, randomized, double-masked human trial, 38 patients with bilateral defects were treated in a split-mouth design. Control subjects received conventional periodontal flap surgery and similar surgery, including vehicle. No local or systemic safety issues were noted, and no patients developed antibodies to the recombinant human growth factors. Two PDGF doses were tested, and the results demonstrated significant bone fill increases in defects treated with the larger amount. Such trials indicate current attempts to deliver growth factors to periodontal defects in order to stimulate a cascade that results in periodontal tissue formation. Many questions remain about the best vehicle or carrier material, application of the growth factors, and the release kinetics of the material.

Carranza's *Clinical Periodontology*, 10th ed (2006), p. 974.

True or false:

Hemisected teeth do not have good long term prognosis.

Answer: False

What is/are the key(s) for long term success?

- 1. Diagnosis*
- 2. Selection of patient*
- 3. Good oral hygiene*
- 4. Careful surgical and restorative management*

- a. 1,2*
- b. 1,2,3,4*
- c. 4*
- d. 1,3*

Answer: b

Relatively simple periodontal therapy is sufficient to maintain these teeth in function for long periods.^{20,31} Other investigators have defined the reasons for clinical failure of root-resected or hemisected teeth.^{2,24} Their data indicate that recurrent periodontal disease is not a major cause of the failure of these teeth. Investigations of root-resected or hemisected teeth have shown that such teeth can function successfully for long periods.^{2,7,24} The keys to long-term success appear to be (1) thorough diagnosis, (2) selection of patients with good oral hygiene, and (3) careful surgical and restorative management.

Carranza's *Clinical Periodontology*, 10th ed (2006), p. 1003.

Langer et al. evaluated 100 patients receiving root resection therapy at least 10 years prior to the study. **Thirty-eight per cent of these teeth failed**, the majority occurring between the fifth and seventh year. Mandibular molars failed at a 2:1 ratio compared to maxillary molars. The latter failed primarily because of progressive periodontal disease, while mandibular molars succumbed most frequently to root fractures.¹⁴ **Blomlöf et al.** reported a very similar success rate of **68% at 10 years**. Smokers seemed to have a threefold risk compared to non-smokers.¹⁵

A study which illustrated more promising results was conducted by **Carnevale et al.** They examined 488 hemisected or root resected teeth. The possible failure mode could have been periodontal, endodontic or restorative. The **failure rate was 5.7%** and only 3.7% of all the teeth had to be extracted. The highest cause of failure was dental caries and root fractures, but not periodontal disease. However, since this is a retrospective study, the number of furcated teeth that were initially extracted is not reported and thus conclusions about the efficacy of surgical treatment of the furcated teeth should be made with extreme caution. The authors explained the higher success rates compared to other studies by the fact that resection therapy is very **technique-sensitive and proper case selection and restorative expertise** are essential.¹⁶

1. Langer B, Stein S D, Wagenberg B. An evaluation of root resections. A ten-year study. *J Periodontol* 1981; **52**: 719–722. | [PubMed](#) | [ChemPort](#) |
2. Blomlöf L, Jansson L, Appelgren R, Ehnevid H, Lindskog S. Prognosis and mortality of root-resected molars. *Int J Periodontics Restorative Dent* 1997; **17**: 190–201. | [PubMed](#) |

This patient presents to your clinic with mild to moderate sensitivity on teeth #24 & 25 which have 4-5 mm gingival recession which extends to the MGJ and has clinical evidence of destruction of the interdental papillae and asks you what type of treatment options may be available. From a periodontal standpoint, what would be your diagnosis, potential treatment, and reasonable chance of success for teeth #24-25.

Diagnosis?

- A. Mucogingival defect on teeth #24 & 25 which is classified as a Miller class III gingival recession, you cannot expect 100% root coverage.
- B. Mucogingival defect on teeth #24 & 25 which is classified as a Miller class III gingival recession, you can expect 100% root coverage.
- C. Mucogingival defect on teeth # 24 & 25 which is classified as a Miller class IV gingival recession, you cannot expect 100% root coverage.
- D. Mucogingival defect on teeth # 24 & 25 which is classified as a Miller class II gingival recession, you can expect 100% root coverage.

Answer is.....

- A. Mucogingival defect on teeth #24 & 25 which is classified as a Miller class III gingival recession, you cannot expect 100% root coverage.

Treatment

Mucogingival surgery (Periodontal plastic procedure) to correct or improve the defect.

1. Free Gingival Graft (FGG)
2. Connective Tissue Graft (CTG)
3. Pedicle Flap (Coronally Positioned Flap-CPF)
4. Guided Tissue Regeneration (GTR)

Miller's Recession Classification

Deals with FGG and CTG primarily

Class I- Marginal tissue recession that does not extend to the MGJ. No bone loss interproximally. 100% root coverage.

Class II- Marginal tissue recession that goes to or into MGJ. No bone loss interproximally. 100% root coverage.

Class III- Marginal tissue recession to or beyond MGJ. Interproximal bone loss or tooth malposition. Less than 100% root coverage (partial).

Class IV- Marginal tissue recession to or beyond MGJ. Interproximal bone loss or tooth malposition so severe root coverage cannot be anticipated.

It is beneficial to classify the interproximal papilla using the system developed by **Nordland** and **Tarnow** because root coverage is highly dependent on these tissues. The classification is as follows:

- **Normal:** Papilla fills the entire gingival embrasure. Complete root coverage is anticipated.
- **Class I:** The crest of the papilla is located between the contact point and the most coronal extent of the interproximal cementoenamel junction (CEJ). Complete to partial root coverage is anticipated.
- **Class II:** The crest of the papilla is at or apical to the interproximal CEJ but coronal to the facial CEJ. Only partial root coverage is anticipated.
- **Class III:** Crest of the papilla is at or apical to the facial CEJ. No root coverage is anticipated. If the interproximal tissues are adequate, the next consideration is the Miller's classification of the recession.

REFERENCES

- Carranza's Clinical Periodontology, 9th Ed. W.B. Saunders, 2002, page
- Miller, PD. Root coverage using a free soft tissue autograph following citric acid application. Int J Periodontics Restorative Dent 2 (1): 65-70,1982.
- Nordland, WP, Tarnow, DP. A classification system for loss of papillary height. J Periodontol 1998 Oct; 69 (10): 1124-1126.

Which of the following antibiotics is indicated for the treatment of aggressive periodontitis?

Answer all that apply.

- A. Amoxicillin + Flagyl
 - B. Flagyl
 - C. TCN
 - D. TCN + Flagyl
 - E. PCN
 - F. Doxycycline
-

Answer is.....

A, C and F

-Amoxicillin + Flagyl

-TCN

-Doxycycline

Antibiotic treatment regimen

Diagnosis	Therapy	Recommended antibiotic
Gingivitis	Prophy/supragingival scaling	Not recommended
Chronic periodontitis	SC/RP Sx.	Not recommended
Aggressive periodontitis	SC/RP Sx.	TCN, Doxycycline or Amox + Flagyl
Refractory periodontitis	SC/RP Sx.	Amox + Flagyl Cipro + Flagyl
NUP (ANUG, NUG)	SC/RP R/o HIV +	Flagyl or PCN

Chemotherapeutic delivery systems

- **Periostat**: (tablet) 20mg doxycycline hyclate

Local Delivery System: Delivered into sulcus

- **Actisite**: Non-absorbable monofilament impregnated with 12.7 mg of TCN
- **Atridox**: 8.5% doxycycline in gelatin delivery system
- **Periochip**: 2.5 mg Chlorhexidine gluconate
- **Arestin**: 1 mg minocycline HCl-extended release over 28 days

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REFERENCES

- **Yang, JC. Chemotherapeutics & Periodontal Therapy, Third year periodontal resident lecture, 7 Aug,2006.**
- **Wolff, L. Periodontology III, Spring semester, University of Minnesota SOD, Spring 2007.**
- **Breault, LG, et al. Local Chemotherapeutics As an Adjunct to Scaling and Root Planing. The Dental Assistant. Nov-Dec 2004.**

Match each with the correct answer.

- **1. Autograft_____ a. graft from another species**
- **2. Xenograft_____ b. graft from identical twins**
- **3. Isograft_____ c. genetically dissimilar members of same species**
- **4. Alloplast_____ d. graft from same individual**
- **5. Allograft_____ e. inert foreign body implanted into**

The Answers are.....

- **1. Autograft d a. graft from another species**
- **2. Xenograft a b. graft from identical twins**
- **3. Isograft b c. genetically dissimilar members of same species**
- **4. Alloplast e d. graft from same individual**
- **5. Allograft a e. inert foreign body implanted Into tissue.**

REFERENCES

- **Johnson, RH. Periodontal surgery-module III-Mucogingival surgery. Dept. of Periodontics, University of Washington, 2000.**

Laser Use in Periodontal Treatment

Periodontal treatment with an Er:YAG Laser (ERL) compared to ultrasonic instrumentation (UI) for non-surgical periodontal treatment: should one expect to see any differences in the treatment outcome?

- a. The laser treatment is superior to UI
- b. UI is superior to laser treatment
- c. No statistically significant differences are observed
- d. Lasers should not be used for periodontal treatment
- e.

Answer: C

Results:

BOP (bleeding on probing): ERL: 40% 10 17% after 6 mos

UI : 46% to 15% after 6 mos

CAL (clinical attachment level): ERL: 1.48 +/- 0.73mm

UI : 1.53+/- 0.67

It can be concluded that both therapies lead to improvements of clinical parameters. An Er:YAG laser may represent a suitable alternative for non-surgical periodontal treatment.

Reference: Journal of Periodontology, July 2004, Vol. 75, No. 7, p. 966-973

March 2001, Vol. 72, No. 3, p. 361-367

New Attachment

True/False:

New connective tissue attachment may form on a previously periodontitis involved root surface provided cells originating from the periodontal ligament are enabled to repopulate the root surface during healing?

Answer:

True: new attachment can be achieved by cells originating from the pdl and the concept that the periodontitis affected root surface is a preventive factor for new attachment is not true.

Reference: J. of Clin. Periodontology, Vol 9, Issue 4, page 290-296, Aug 1982

Goals of Scaling / Root Planing: True/ False:

- a. It is almost impossible to achieve calculus free roots
- b. Flap access nearly doubles the operator's ability to remove calculus
- c. Furcation areas continue to harbor significant amounts of calculus after SC/RP with or without the benefit of a flap.

- d. SC and RP are effective methods of mechanical debridement when periodontal pockets exceed 3mm depth

Answer: **all are true**

Ref: a,b,c: Drisko, and Killoy: Scaling and Root planning: removal of calculus and subgingival organisms. Curr Opin Dent, 1991, Feb, 1: 74-80

Ref d: JADA, 2003, Vol 134, No 2, 259: Treating Periodontal Disease: Scaling and Root Planing.

Smoking and Periodontal Disease

True/False:

- a. The effect of smoking on periodontitis shows no association with age or sex ?
- b. Probing attachment levels (PAL) will increase the more cigarettes a person smokes per day?
- c. In patients with moderate to severe periodontal disease smoking is associated with elevated GCF levels of the cytokine TNF-alpha ?

Answers:

- a. True**
- b. True**
- c. True**

Reference for a and b:

One per day: PAL= 0.5% increase

10 per day: PAL = 5% increase

20 per day: PAL = 10% increase

Tobacco increases periodontal disease severity. This effect is clinically evident above consumption of a certain quantity of tobacco.

J. Clin. Perio. Oct 1995, Vol. 22, Issue 10, page 743-749

Reference for c.

J. Clin. Perio, 1998, Oct, 25 (10) 767-773

Which of the following medications has NOT been associated with gingival enlargement?

- A. Erythromycin.
- B. Oral contraceptives.
- C. Valproic acid.
- D. Fluconazole.

E. Verapamil.

Answer: D. Fluconazole.

The terms gingival hyperplasia and gingival hypertrophy are actually misnomers because neither of these histologic features are associated with the condition in either the epithelial or connective tissues. The clinical appearance results from overproduction of extracellular matrix, especially collagen.

The following **anticonvulsants** have been associated with gingival enlargement: carbamazepine (Tegretol), ethosuximide, ethotoin, felbamate, mephenytoin, methsuximide, phenobarbital, phenoximide, **phenytoin (Dilantin)**, primidone, sodium valproate/valproic acid.

Calcium channel blockers are also associated: amlodipine (Norvasc), bepridil, diltiazem (Cardizem), felodipine, nifedipine, **nifedipine (Procardia)**, nimodipine, nitrendipine, verapamil.

The following have also been associated: **cyclosporine, erythromycin, oral contraceptives.**

Incidence – percent of patients using the medication who see gingival enlargement: 50%/phenytoin 25%/cyclosporine 25%/nifedipine

The condition is most prevalent in the anterior area, and may progress to cover most of the crown of the tooth. Poor oral hygiene is positively and significantly correlated with more gingival overgrowth.

Treatment of choice: Discontinuation of the offending medication. Palliative treatment may include gingivectomy by traditional, electrosurgical or chemosurgical techniques.

Reference: Neville *et al.* *Oral and Maxillofacial Pathology*, 2nd Ed. W.B. Saunders Company. 2002. pp. 145-148.

A patient presents with an asymptomatic radiolucency and you suspect an endodontic or periodontal origin. Which of the following is the BEST way to differentiate between these two etiologies?

- A. Perform scaling and root planing on the tooth and reevaluate the presence of the lesion after 4 weeks.
- B. Carefully evaluate the vitality of the suspect tooth and neighboring teeth.
- C. Biopsy the lesion and make a diagnosis from the pathologist's report.
- D. Probe carefully around the tooth to check for a narrow, deep pocket suggesting an endodontic cause.
- E. Perform a pulpectomy and scale/root plane around the tooth that day.

Answer: B. Carefully evaluate the vitality of the suspect tooth and neighboring teeth.

An asymptomatic lesion that is endodontic in origin will almost always be associated with a non-vital tooth. If the tooth in question has been previously treated endodontically, additional diagnostic information will need to be gained by careful probing measurements, searching for/tracing sinus tracts with gutta percha, evaluation of pain history, and evaluation of the location of the lesion. Periodontal lesions are associated with wide, broad pockets, while endodontic lesions tend to produce narrower pockets. Keep in mind that this is a guideline, and not a hard and fast rule. An endodontic lesion that has established drainage from an apical area and been in place chronically may be associated with significant loss of periodontal attachment and have a broader pocket. In general, however, a periodontal lesion will ALWAYS have a broader pocket than an endodontic lesion.

Treatment of Choice: As a general rule, you should ALWAYS treat endodontic pathology first and delay periodontal therapy (up to ten weeks). Bone loss associated with pulpal disease will regenerate if the root canal therapy is adequate. Performing initial periodontal therapy to treat an endodontic lesion will destroy the gingival attachment apparatus and can cause the development of a chronic periodontal defect (gross calculus may be removed, if present). Keeping in mind that true combined endodontic/periodontic lesions are exceedingly rare, every effort should be made to determine the principal cause of the lesion and address it. It is more common for endodontic lesions to involve the periodontium than for periodontal lesions to involve the pulp; the latter seems to happen predominately when bone loss reaches the apical foramen.

Possible diagnoses: Endodontic only.
 Periodontic only.
 Primary endodontic, secondary periodontal.
 Primary periodontal, secondary endodontic.
 True combined endodontic/periodontal.

References:

- Walton RE, Torabinejad M. *Principles and Practice of Endodontics*, 3rd Ed. W.B. Saunders Company. 2002. pp. 466-484.
- Simon JH, Glick DH, Frank AL. The relationship of endodontic-periodontic lesions. *J Periodontology*. 1972 Apr; 43(4): 202-8.

Sonic and ultrasonic scalers are contraindicated in patients with transmissible diseases. Sonic and ultrasonic scalers are contraindicated in patients with cardiac pacemakers.

- A. Both statements are true.
- B. Both statements are false.
- C. The first statement is true, the second statement is false.
- D. The first statement is false, the second statement is true.

Answer: C. The first statement is true, the second statement is false.

Both types of powered-scalers should not be used in patients with transmissible disease since aerosols and spatter are generated. This is especially true when subgingival instrumentation is performed as blood components are incorporated into the aerosol/spatter. A pre-operative

antiseptic rinse (chlorhexidine) may reduce microbial content in aerosols if scaling is limited to supragingival sites. Use of the high-vacuum suction is indicated during powered-scaling.

The only scalers contraindicated in patients with cardiac pacemakers are **magnetostrictive ultrasonic scalers** (ie: Cavitron). These scalers oscillate when a live coil generates an alternating electromagnetic (EM) field inside the instrument that causes subsequent expansion/contraction of either nickel-iron strips or a Ferrite insert. This expansion/contraction is transferred into oscillations in the tip (elliptical). This EM field is the part that interferes with the cardiac pacemakers.

Sonic scalers work using compressed air from the dental unit. It drives a rotating cam within the instrument causing the vibration of the tip (circular). Sonic scalers are very effective at removing plaque/calculus.

Piezoelectric ultrasonic scalers work by changing the dimension of a quartz crystal by application of an alternating current. This results in a back/forth motion of the tip.

Reference: Newman MG, Takei HH, Carranza FA. *Carranza's Clinical Periodontology*, 9th Ed. W.B. Saunders Company. 2002. pp. 607-611.

Which of the following inflammatory molecules have key roles in the pathogenesis of periodontitis?

- A. IL-1 α
- B. IL-1 β
- C. TNF- α
- D. PGE₂
- E. All of the above.
- F. A, B, C only.

Answer: E. All of the above.

The two pro-inflammatory cytokines **IL-1 (Interleukin-1)** and **TNF (Tumor necrosis factor)** have central roles in the destruction of periodontal tissues. Both come in two forms α and β (the difference between them will not be discussed here). IL-1 and TNF- α are produced primarily by activated macrophages (TNF- β is produced by CD4 T-cells). Bacterial LPS and the presence of IL-1 also cause upregulated IL-1 production \rightarrow IL-1 essentially upregulates its own formation, making it a key molecule involved with bone loss. The result of the action of these molecules is activation of host defenses and ultimately destruction of the periodontal attachment apparatus. Both are found in high quantities in GCF from diseased periodontal pockets.

Prostaglandin E₂ (PGE₂) has been associated with significant bone loss in periodontitis patients. It is a metabolite of the arachidonic acid pathway and is released from monocytes. Higher levels are released in patients with severe or aggressive periodontitis compared to those with mild or no disease. The use of NSAID's decreases formation of PGE₂. Some have postulated that a "monocyte hypersecretory trait" may result in an exaggerated immune response to periodontal irritants.

Reference: Newman MG, Takei HH, Carranza FA. *Carranza's Clinical Periodontology*, 9th Ed. W.B. Saunders Company. 2002. pp. 607-611.

According to Page and Schroeder's article "Pathogenesis of Inflammatory Periodontal Disease (1976), which statement(s) in the following list are correct?"

- A. The stages of pathogenesis are defined as the initial lesion, the early lesion, the conventional lesion and the advanced lesion.
- B. Formation of periodontal pockets and periods of quiescence and exacerbation are both features of the advanced lesion.
- C. The early lesion is characterized by the migration of leukocytes into the junctional epithelium, but without appreciable bone loss.
- D. The early lesion appears at the site of the initial lesion within 4-7 days following the beginning of plaque formation.
- E. Page and Schroeder concluded that plaque has the capacity to initiate all the lesions except the advanced lesion.

- 1. A, B & E
- 2. B, C & D
- 3. B, D & E
- 4. C, D & E
- 5. All of the above
- 6.

Answer is:

- 3. B, D & E

The stages of pathogenesis are defined as the initial lesion, the early lesion, the conventional lesion and the advanced lesion. (False)

The stages of pathogenesis are initial lesion, early lesion, established lesion and the advanced lesion.

Formation of periodontal pockets and periods of quiescence and exacerbation are both features of the advanced lesion. (True)

Features of Initial Lesion: (2-4 days)

- 1. Classic vasculitis of vessels subjacent to the junctional epithelium (JE).
- 2. Exudation of fluid from the gingival sulcus
- 3. Increased migration of leukocytes into the JE and sulcus
- 4. Presence of serum proteins, especially fibrin extravasularly.
- 5. Alteration of the most coronal portion of the JE.
- 6. Loss of perivascular collagen

Features of Early Lesion: (4-7 days)

1. Presence and accentuation of the features described for the initial lesion.
2. Accumulation of lymphoid cells immediately subjacent to the JE at site of acute inflammation.
3. Cytopathic alterations in resident fibroblasts possibly associated with interactions with lymphoid cells.
4. Further loss of the collagen fiber network supporting the marginal gingival.
5. Beginning proliferation of the basal cells of the JE.

Features of the Established Lesion: (2-3 weeks)

1. Persistence of the manifestations of acute inflammation.
2. Predominance of plasma cells but without appreciable bone loss.
3. Presence of immunoglobulins extravascularly in the CT and JE.
4. Continuing loss of CT substance noted in the early lesion.
5. Proliferation, apical migration, and lateral extension of the JE. Early pocket formation may or may not be present.

Features of the Advanced Lesion: (>3 weeks)

1. Persistence of features described for the established lesion.
2. Extension of lesion into alveolar bone and PDL with significant bone loss.
3. Continued loss of collagen subjacent to pocket epithelium with fibrosis at more distant sites.
4. Presence of cytopathically altered plasma cells in the absence of altered fibroblasts.
5. Formation of periodontal pockets.
6. Periods of quiescence and exacerbation.
7. Conversion of the bone marrow distant from the lesion into fibrous CT.
8. Widespread manifestations of inflammatory and immunopathologic tissue reactions.

The early lesion is characterized by the migration of leukocytes into the junctional epithelium, but without appreciable bone loss. (False)

See above-early lesions

The early lesion appears at the site of the initial lesion within 4-7 days following the beginning of plaque formation. (True)

See above-early lesions

Page and Schroeder concluded that plaque has the capacity to initiate all the lesions except the advanced lesion. (True)

Plaque does not solely have the capacity to initiate an advanced lesion. Plaque can initiate the disease process, but the advanced lesion requires the presence of cytopathically altered plasma cells and the absence of altered fibroblasts.

Reference

Page RC, Schroeder HE, Pathogenesis of Inflammatory Periodontal Disease-A summary of current work. Lab Invest. pp 235-248, Vol 34, No.3 1976.

ORAL SURGERY

Prevention of alveolar osteitis is commonly managed by:

- 1). Polylactic acid
 - 2). Preoperative chlorhexidine mouthwash
 - 3). Clindamycin on gelatin sponge
 - 4). tetracycline powders in sockets
- A. (1) and (3)
B. (1) and (4)
C. (1), (2) and (3)
D. (2), (3) and (4)
E. All of the above

Answer: D

Alveolar Osteitis, commonly referred to as dry socket, is not associated with infection but may cause delay in healing. The usual clinical presentation is after 3 to 4 days of surgery and the socket appears to be empty with a partially or completely lost blood clot. This exposed bone is extremely sensitive and is the source of pain.

The etiology of alveolar osteitis is not completely clear, but prevention of dry socket includes:

- Minimizing trauma and bacterial contamination in the surgery area.
- Thorough debridement of the area with large quantities of saline
- Small amount of antibiotics such as tetracycline or clindamycin, placed in the socket.
- Gelatin sponge may be placed in socket
- Pre and post operative rinses with antimicrobial mouthrinses, such as CHX

Best way to treat is by gentle irrigation with saline and small strip of iodoform gauze soaked in eugenol placed into the socket. The patient should feel relief within 5-10 minutes. The dressing should be changed every other day for the following 3 to 6 days until the pain decreases.

J. Peterson, et al., 4th ed. 236-237

Benzodiazepines are classified as FDA category B for pregnant women and therefore the dentist should have no problems with its administration. Lidocaine is category class X and is contraindicated in any portion of pregnancy.

1. Both statements are true
2. First statement is true and the second is false
3. Second statement is true and the first statement is false

4. Neither statement is true.

Answer: 4

Benzodiazepines are a category D/X which should be completely avoided during pregnancy and breast-feeding. Drugs in the A or B category are preferred for prescribing. Pregnancy is considered a relative contraindication to elective dental care, especially during the first trimester. Local anesthetics and vasopressors are not teratogens and may be administered to pregnant patients during any trimester; however, administration of it should be very conservative.

Food and Drug Administration categorization of prescription drugs are for pregnant patients based on their risk of fetal injury. There are 5 categories:

- A.** [Generally considered safe] Controlled studies in pregnant women fail to demonstrate a risk to the fetus in the first trimester with no evidence of risk in later trimesters. The possibility of fetal harm appears remote.
Example: Multivitamins

- B.** [Caution advised] Either animal-reproductive studies have not demonstrated a fetal risk but there are no controlled studies in pregnant women, **OR** animal-reproduction studies have shown an adverse effect that was not confirmed in controlled studies in women in the first trimester and there is no evidence of a risk in later trimesters.
Examples: Pen VK, Lidocaine, Prednisone

- C.** [Weigh risk and benefit] Animal studies have shown adverse fetal effect(s) but no controlled human studies **AND** there are no controlled studies in women, or studies in women and animals are not available. Drugs should be given only if the potential benefits justify the potential risk to the fetus.
Examples: Glucotrol, Advair

- D.** [Weigh risk and benefit] Positive evidence of human fetal risk; maternal benefit may outweigh fetal risk in serious or life-threatening situations; see package insert for drug-specific recommendations.
Example: Diazepam, Barbiturates

- X.** [Contraindicated] Positive evidence of serious fetal abnormalities in animals, humans, or both; fetal risks clearly outweigh maternal benefits.
Examples: Casodex (antineoplastic agent for prostate cancer)

Malamed SF, 5th ed *Local Anesthesia*; 2004, pp146-147;

Little et al, 5th ed *Dental Management of the medically compromised patient*; 1997, pp 438-439.

Wynn RL et al, 9th ed *Drug Information Handbook for Dentistry 2003*, p 10.

Most dentists use a combination of drugs to control postoperative pain. Which statement gives the true reason?

1. Adding codeine to a combination of NSAID and acetaminophen enhances the effectiveness of pain control significantly.
2. Despite the side effects, when drug combinations include an opioid, consistently superior pain control is achieved
3. The combination of an NSAID with acetaminophen provides more effective pain control than using codeine and acetaminophen together.
4. Combinations of drugs can take advantage of different pain relief pathways and mechanisms.

- A. (1) and (2) only
- B. (2) and (3) only
- C. (3) and (4) only
- D. (1), (2) and (3) only
- E. (2), (3) and (4) only

Answer: C

Using a combination of drugs to control postoperative dental pain is an effective practice because it takes advantage of the fact that different analgesics work through a variety of pathways and mechanisms. Prior to the introduction of NSAIDs, a combination of either aspirin or acetaminophen with an opioid was the first drug of choice to control moderate to severe pain. Currently, when NSAIDs are used in conjunction with acetaminophen, pain relief is more effective and consistent over the period of the administered dose. This combination also avoids the deleterious side effects associated with opioid drugs.

Attempts to gain increased measures of pain control by adding codeine to the NSAID/acetaminophen combination have not resulted in any statistically significant increases in analgesia. 30-40% of patients experienced adverse reactions when the opioid drug was introduced into the formula. At present, no marketed drug combination contains both an NSAID and acetaminophen.

Dionne R. *Additive analgesia without opioid side effects*. *Compend Contin Educ Dent* Jul 2000; 21(7): 572-577.

During the extraction of a mandibular premolar, the crown is fractured 3mm below the crest of the bone. Which of the following is the LEAST traumatic method for removing the fractured root?

- A. Firmly grip the tooth using #150 forceps
- B. Divide the root using surgical burs

- C. Flap and remove sufficient bone for access
- D. Luxate the root using an elevator
- E. Firmly grip the tooth using a Cryer

Answer: C

If the closed technique (also known as simple, or forcep technique) is unsuccessful, the surgeon should switch without delay to the open technique. Open technique is also known as the surgical technique. It is important for the surgeon to recognize that a smooth, efficient, properly performed open retrieval of a root fragment is less traumatic than a prolonged, time-consuming, frustrating attempt at closed retrieval.

A and B: #150 forceps are the universal instruments for maxillary teeth. #151 are the universal forceps for mandibular teeth. The mandibular premolar are among the easiest teeth to remove; roots are conical and straight.

D and E: Elevators are helpful for the mobilization and engaging of tooth structure. However visibility should be secured to avoid “rummaging” in the dark. Cryer elevator is shaped with a pointed tip that engages into the tooth and is used to rotate outwards.

Peterson et al., 3rd edition. pg 168, 207

Which mandibular molar impaction would be the most challenging to remove?

- (1) distoangular
- (2) mesioangular
- (3) Pell and Gregory Class 1 ramus and Class A depth
- (4) Pell and Gregory Class 3 ramus and Class B depth
- (5) Pell and Gregory Class 3 ramus and Class C depth

- A. (1) and (2)
- B. (2) and (3)
- C. (2) and (5)
- D. (1) and (4)
- E. (1) and (5)

Answer: E

Distoangular impaction is the tooth considered most difficult because the tooth has a withdrawal pathway that runs into the mandibular ramus. Mesioangular is generally acknowledged as the least difficult impaction to remove.

Distoangular



Mesioangular



Vertical



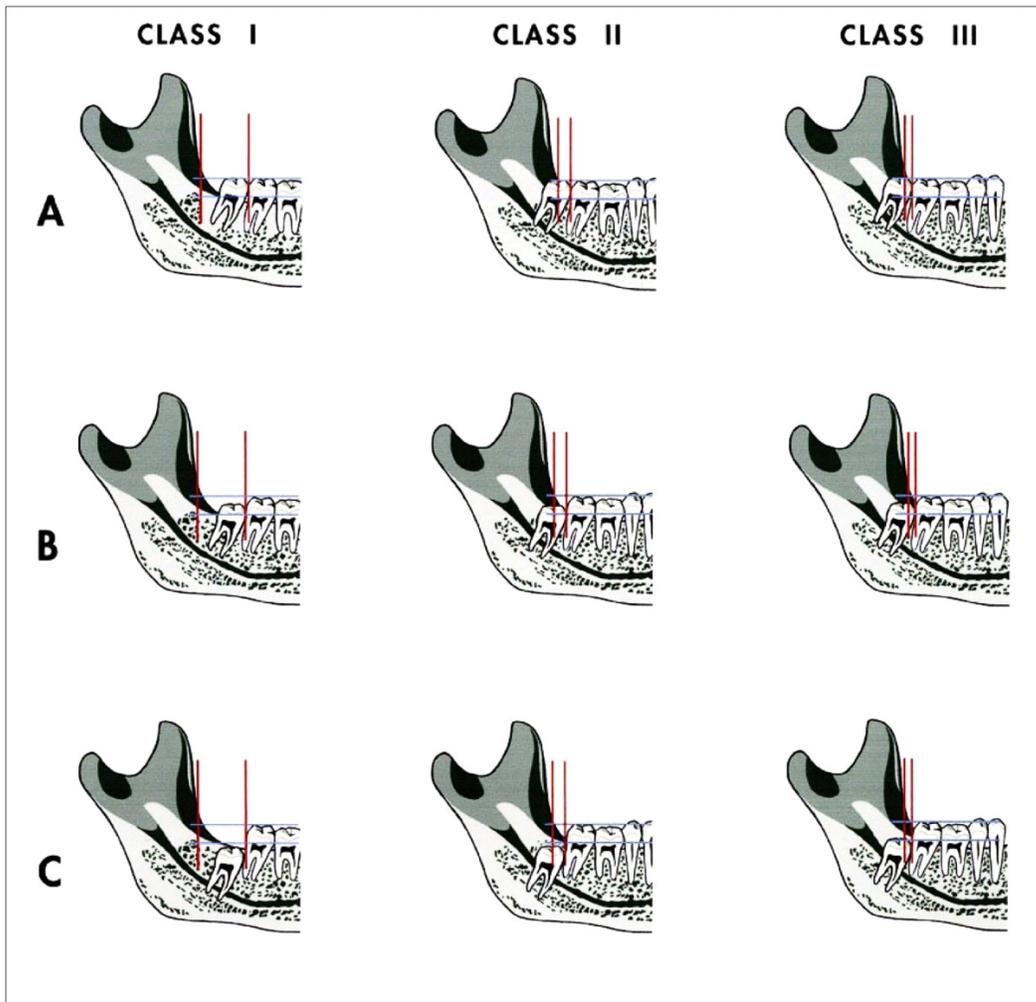
Horizontal



There are three different classifications of impacted 3rd molars; a) angulation of the impacted 3rd molar relative to the long axis of the 2nd molar, b) Pell and Gregory Class 1, 2, and 3 and 3) Pell and Gregory Class A, B and C.

Pell and Gregory Class 1, 2, and 3 are based on the amount of impacted tooth that is covered with the bone of the mandibular ramus.

Pell and Gregory Class A, B, and C relates the impacted tooth to the height of the adjacent second molar. The degree of difficulty is measured by the thickness of the overlying bone – the thicker the bone, the more difficult the extraction.



Monaco G et al. *Reliability of panoramic radiography in evaluating the topographic relationship between the mandibular canal and impacted third molars*. JADA 2004;135 (3): 312-318.

J. Peterson, et al., 3rd ed. 225-231

You are performing removal of a maxillary third molar when suddenly you lose sight of the tooth. A thorough search of the oral cavity does not reveal the tooth. Which of the following scenarios requires immediate emergency treatment? You may select more than one answer.

- a. The tooth was displaced into the maxillary sinus.
- b. The tooth was displaced posteriorly into the infratemporal space.
- c. The tooth was lost down the oropharynx.
- d. The tooth was displaced into the maxillary sinus and was grossly carious.

Answer: c

Impacted maxillary third molars are occasionally displaced into the maxillary sinus or posteriorly displaced into the infratemporal space. If the tooth enters the infratemporal fossa it is usually lateral to the lateral pterygoid plate and inferior to the lateral pterygoid muscle. If access and light are good an effort to retrieve the tooth is recommended using hemostats. If the tooth is not visible the procedure should be stopped the surgery site should be closed. The patient should be informed of the displaced tooth and that it will need to be removed later. Antibiotics should be prescribed to decrease the possibility of post-op infection. The tooth should fibrose in position and can be removed by an oral surgeon 4 to 6 weeks later.

If a large root fragment or the entire tooth is displaced into the maxillary sinus it needs to be removed. The usual method is by the Caldwell-Luc approach into the maxillary sinus via the canine fossa region. This patient needs to be referred to an oral surgeon for this procedure. If the displaced tooth fragment is small (2 to 3 mm) and the tooth and the sinus have no preexisting infection, the surgeon should make minimal effort to remove the root. A radiograph should be taken. Attempt to remove the fragment with irrigation and suction through the socket. If this method is not successful the root tip should be left in place. The oroantral communication should be closed with a figure-eight suture, instructions for sinus precautions, antibiotics and nasal spray to prevent infection and to keep the sinuses open. The root tip should fibrose onto the sinus membrane. If the root was infected or the patient has chronic sinusitis the root tip should be removed by an oral surgeon using the Caldwell-Luc approach.

If the tooth is lost down the oropharynx the patient should be turned on his side. You may attempt to suction the tooth out and the patient is encouraged to cough and spit the tooth onto the floor. If the tooth is not produced it was likely either swallowed or aspirated. In the absence of coughing or respiratory distress it like that the patient swallowed the tooth. In either case the patient needs to be taken to the emergency room for chest and abdominal radiographs. If the tooth has been aspirated removal is needed via a bronchoscope. Maintaining the patient's airway and breathing are of the utmost importance. If the tooth has been swallowed it should pass in 2 to 4 days.

Ref: Contemporary Oral and Maxillofacial Surgery. 4th Ed. Larry J. Peterson. 2003. Pages: 224-6.

During the removal of a mandibular third molar you fracture the root leaving a small root fragment behind. The fragment is still visible. You decide to try to tease it out with a root tip pick but when you do it disappears through the lingual cortical plate. What should be your next step?

- a. Reflect a lingual flap and try to locate the root fragment.**
- b. Refer to the oral surgeon today for immediate removal.**
- c. Attempt to force the root tip back into the socket by placing finger pressure on**

the lingual aspect of the mandible and then gently tease the root out with a root tip pick.

- d. Leave the root tip in place and inform the patient. Perform yearly radiographic examination of the area.**

Answer: c

Fractured mandibular root tips can sometimes be displaced through the lingual cortical plate and into the submandibular space. The lingual cortical plate thins as you move further posterior. Sometimes the roots are already through the lingual plate before you begin surgery. A small amount of apical pressure will force these root tips into the submandibular space. Prevention of using apical pressure when removing roots is the best way to avoid this complication. Use of a straight elevator with apical force is contraindicated. Use of a Cryer elevator is more appropriate. By design the Cryer elevator will lift the root out of the socket rather than place apical force on it. This can only be useful if you have enough root remaining to engage with the Cryer elevator. Trying to tease the root tip out with a root tip pick is only recommended if the root tip appears loose otherwise you are likely to force it more apical. If the root does disappear apically place pressure on the lingual aspect of the mandible at the floor of the mouth and try to force the root back into the socket at which time you can then try to tease it out with a root tip pick. You should only attempt this once. If you are unsuccessful discontinue the procedure and refer the patient to an oral surgeon. Definitive treatment will involve reflecting a lingual flap and gently dissecting the overlying mucosa until the root tip can be found. This procedure should only be performed by experienced surgeons often under general anesthesia to avoid nerve damage. The surgeon may decide to leave the fragment in place if it is small and was uninfected preoperatively. If the fragment is left in place the patient must be informed of the decision and why it was chosen (you feel it will be less harmful to leave the fragment in place than to try to retrieve it). A radiograph must be taken and placed in the record to document the position of the root fragment. You must document that the patient was informed of the decision to leave the fragment in place in the record. Finally the patient must be recalled for several routine follow-up visits over the next year to track the root fragment. The patient should be informed to contact the surgeon immediately if any problems develop in the area of the retained root fragment.

Other possible places a root could be displaced on the mandible include the mandibular canal and the sublingual space.

Ref: Contemporary Oral and Maxillofacial Surgery. 4th Ed. Larry J. Peterson. 2003. Pages: 180, 225.

Which of the following are indications for leaving a root fragment in place?

- a. A fragment up to 5mm long.**
- b. The root is deeply embedded in the bone.**
- c. The root has no sign of infection or apical radiolucency associated with it.**

- d. b and c only.**
- e. a, b and c.**

Answer: e

The surgeon must weigh the risks versus benefits of trying to removed a fractured root fragment. The following three conditions must exist for a root fragment to be left in the socket. One, the fragment must be no longer than 4 to 5 mm. Second, the fragment must be embedded in the bone. Exposed and superficial fragments will interfere with the future prosthesis by resorbing bone and continuing to erupt. Third, the fragment must not be infected or have a radiolucency around the apex. This decreases the likelihood of future infections. If the risk of surgery outweigh the benefit of removing a non-infected root tip than the root tip should be left in place. These risks include potential extensive damage to the surrounding tissues required to remove the fragment, possible endangerment to vital structures such as nerves and possible displacement of the fragment into tissue spaces or the maxillary sinus.

Ref: Contemporary Oral and Maxillofacial Surgery. 4th Ed. Larry J. Peterson. 2003. Pages: 179-80.

**Which of the following statements are true with respect to mandibular fractures?
Choose all that apply.**

- a. The angle of the mandible is the most common site of fracture.**
- b. The neck of the condyle is the most common site of fracture.**
- c. Males are more affected than females.**
- d. Most fractures occur during the teenage years.**
- e. Most fractures are sports related.**

Answer: a, c

Fractures are most commonly related to road crashes, falls and violence. Of 509 patients males had more fractures than females by a ratio of 3.6:1. Men ages 21-30 and females ages 0-10 were most affected. The angle of the mandible was affected 22% of the time, followed by the parasymphseal area 21% of the time and the coronoid region 1% of the time.

Ref: Sakr K, Farag IA, Zeitoun IM. Review of 509 mandibular fractures treated at the University Hospital, Alexandria, Egypt. Br J Oral Maxillofac Surg. 2006 Apr; 44(2):107-11.

Of 2901 patients 77.5% of the facial fractures were seen in males. They were more frequent in the Summer at 36.3%. Traffic accidents were the largest cause at 38%. They were seen more frequently in the 0-10 year age group.

Ref: Erol B, Tanrikulu R, Gorgun B. Maxillofacial fractures. Analysis of demographic distribution and treatment in 2901 patients (25-year experience). J Craniomaxillofac Surg. 2004 Oct;32(5):308-13.

In a study involving 2252 patients affected males greatly outnumbered affected females by 5 times. Ages 20-29 were most affected. Assault was the number one cause for the fractures at 68%. Angle of the mandible was most affected (34.15%), followed by body of the mandible (25.77%), and symphysis (19.57%).

Ref: Atanasov DT. A retrospective study of 3326 mandibular fractures in 2252 patients. Folia Med (Plovdiv). 2003;45(2):38-42.

In a study of 4381 active duty army patients most fractures were located at the angle of the mandible (35.6%), followed by the symphysis (20.1%), subcondylar (14.2%), body (12.7%), condylar process (9.1%), ramus (4.5%), alveolar border (2.7%) and coronoid process (1%). Fighting accounted for the majority of fractures at 36.2%. Automobile accidents resulted in 18.6%, athletics 13.6%, falls 9.7% and motorcycle accidents 3.1%. Automobile accidents were most often associated with fractures of the body of the mandible, while fighting usually resulted in fractures at the angle of the mandible.

Ref: Boole JR, Holtel M, Amoroso P, Yore M. 5196 mandible fractures among 4381 active duty army soldiers, 1980 to 1998. Laryngoscope. 2001 Oct;111(10):1691-6.

You are performing extraction of two mandibular 3rd molars. The patient received 2 carpules of lidocaine w/1:100,000 epi and 2 carpules of bupivacaine w/1:200,000 epi during the procedure. How many mg of each anesthetic solution and epinephrine has the patient been given? Assume all carpules contain 1.8cc of solution.

- a. 68mg lidocaine, 18mg bupivacaine, .052mg epi.
- b. 68mg lidocaine, 27mg bupivacaine, .061mg epi
- c. 72mg lidocaine, 18mg bupivacaine, 0.054mg epi
- d. 72mg lidocaine, 54mg bupivacaine, 0.09mg epi

Answer: c

The following tables will help you figure out the necessary calculations:

Concentration	Milligrams per milliliter
1:1,000	1.0
1:2,500	0.4
1:10,000	0.1
1:20,000	0.05

1:30,000	0.033
1:50,000	0.02
1:80,000	0.0125
1:100,000	0.01
1:200,000	0.005

Anesthetic Agent	Concentration
Lidocaine (Xylocaine)	2%
Bupivacaine (Marcaine)	0.5%
Mepivacaine (Polocaine/Carbocaine)	3% w/o vaso, 2% w/vaso
Prilocaine (Citanest)	4%
Etidocaine (Duranest)	1.5%
Articaine (Septocaine)	4%
Procaine (Novocaine) Ester	2 to 4%

Calculation of milligrams per cartridge

Percent solution	Milligrams per milliliter	Volume of cartridge	Milligrams per cartridge
0.25 =	2.5 x	1.8 =	4.5
0.40 =	4.0 x	1.8 =	7.2
0.50 =	5.0 x	1.8 =	9.0
1.0 =	10.0 x	1.8 =	18.0
1.5 =	15.0 x	1.8 =	27.0
2.0 =	20.0 x	1.8 =	36.0
3.0 =	30.0 x	1.8 =	54.0
4.0 =	40.0 x	1.8 =	72.0

For our patient above the calculation is as follows:

The lidocaine concentration is 2% which equals 20 mg/ml x 1.8ml = 36.0mg per carpule. There are 2 carpules so we used 72mg of lidocaine.

The bupivacaine concentration is 0.5% which equals 5.0mg/ml x 1.8ml = 9.0mg per carpule. There are 2 carpules so we used 18mg of bupivacaine.

For the epinephrine we need to calculate the amount used for each anesthetic and then add them together. For the lidocaine we know the concentration is 1:100,000 which equals 0.01mg/ml x 1.8ml = 0.018mg per carpule. There are 2 carpules so we used 0.036mg of epi. For the bupivacaine we know the concentration is 1:200,000 which equals 0.005mg/ml x 1.8ml = 0.009mg per carpule. There are 2 carpules so we used 0.018mg of epi. The total amount of epi used than equals 0.036 + 0.018 = 0.054mg.

Our final answer is: 72mg lidocaine, 18mg bupivacaine, 0.054mg epi.

Reference used: S F Malamed, C L Quinn. Handbook of Local Anesthesia. Third Edition. 1990. Pgs 38, 46-65, 95.

What is a **choristoma**?

- a. dysmorphic proliferation of tissue that is not native to the site.
- b. neoplasias that arise from multiple germ layers and produce tissues that are foreign to the site.
- c. dysmorphic proliferation of tissue native to the site that does not have the capacity for continuous growth or infiltration to surrounding tissues.
- d. composed of tissue elements normally found at that site but that are growing in a disorganized mass.
- e. relatively common, benign, epithelial tumor that was previously considered to be a variant of squamous cell carcinoma (SCC).
- f. limited cellular proliferation, they may resemble neoplasms clinically and histologically but the process stops with the removal of the stimulus.

Answer: a.

a. Choristoma: dysmorphic proliferation of tissue that is not native to the site. Examples: **Fordyce granules (ectopic sebaceous glands)**, **heterotopic GI cyst** that can be found in the tongue and floor of the mouth of infants containing GI glandular structures, bone or cartilage in the tongue, thyroid tissue in the posterior are of the tongue.

b. Teratoma: True neoplasm with capacity of continual growth. They are neoplasias that arise from multiple germ layers and produce tissues that are foreign to the site.

c. Hamartoma: dysmorphic proliferation of tissue native to the site that does not have the capacity for continuous growth or infiltration to surrounding tissues. Ex. **Hemangioma, pigmented nevi, odontoma.**

tissues that are foreign to the site. Rarely seen in the neck, jaws and floor of the mouth.

f. Hyperplasia: limited cellular proliferation, they may resemble neoplasms clinically and histologically but the process stops with the removal of the stimulus. Ex. **Intraoral fibroma, peripheral giant cell proliferation.**

Reference: Marx R, Stern D. Oral and maxillofacial pathology a rationale for diagnosis and treatment. 2003; p255-257

Which of the following is/are true for hemangioma?

- A. Benign proliferation of vessels that may be expressed at any time of life.
 - B. Arteriovenous hemangiomas (AVHs) are the most serious of all the hemangiomas and life threatening.
 - C. Cavernous hemangiomas have a classic presentation of a soft diffuse puffy mass in the parotid, and in the skin over the parotid region as well as within bone, mostly in the posterior mandible.
 - D. The ideal therapy for AVHs is selective embolization followed by surgery
 - E. All of the above
-

Answer: E.

Hemangioma: Benign proliferation of vessels that may be expressed at any time of life. They should be distinguished from true neoplasms like angiosarcomas with continuous cell division without true vessel formation.

Cherry hemangioma: Small 0.1-1cm, superficial, usually first appear in adults at age 35 to 40 years. Have no known malignant transformation.

Cavernous hemangiomas have a classic presentation of a soft diffuse puffy mass in the parotid, and in the skin over the parotid region as well as within bone, mostly in the posterior mandible.

Arteriovenous hemangiomas (AVHs) are the most serious of all the hemangiomas and life threatening. The ideal therapy for AVHs, particularly within the jaws, is selective embolization followed by surgery. The goal is to reduce and the blood flow to the lesion so it can be excised with minimal blood loss. There are different materials and embolization techniques: coils, 100% alcohol, polyvinyl alcohol (PVA) beads. The timing for surgery following embolization depends on the material used for embolization. If solid or bulky materials are used, such as coils, fat, muscle, or Gelfoam the surgery should follow soon after, the same day or day after. If alcohol or liquids are used the surgery should be delayed 72 hours.

Reference: Marx R, Stern D. Oral and maxillofacial pathology a rationale for diagnosis and treatment. 2003; p.437-455

Which is the nerve most commonly affected during mandibular 3rd molar extractions?

- a. Mental nerve
- b. Lingual nerve
- c. Inferior alveolar nerve
- d. Buccal nerve

Answer: c. Inferior alveolar nerve

Mental nerve- paresthesia lip and chin- if sectioned at its exit or torn along its course it is likely that mental nerve function will not return. Rarely it is advisable to make vertical releasing incisions at the interdental papilla between the canine and the 1st premolar.

Lingual nerve- located against the lingual aspect of the mandible in the retromolar pad, rarely regenerates if severely traumatized, incisions should be made well to the buccal aspect of the mandible

Nasopalatine nerve- frequently sectioned during flap surgery for impacted teeth, reinnervation usually rapidly.

Buccal nerve- frequently sectioned during flap surgery for impacted teeth, reinnervation usually rapidly.

Inferior alveolar nerve- common injury during 3rd molar extractions, inform pt. on a routine basis.

Nerve damage after administration of an inferior alveolar nerve block is a documented, but very rare, intraoperative complication. Both the lingual and mental nerves are at risk during elevation of the mandibular mucoperiosteum. Careful flap design and elevation are important to avoid nerve injury while working on the buccal surface of the mandible in the region of the mental foramen or posterior mandible. The mental foramen may be located at or near the crest of an atrophic mandible. To avoid damage to the mental nerve in patients with atrophic mandibles, the clinician may need to make incisions in the area of the mental foramen that are lingual to the crest of the mandible.

Placement of mandibular endosseous implants can result in damage to the lingual nerve, the inferior alveolar nerve or both nerves. The risk of nerve injury depends on multiple factors, including administration of inferior alveolar nerve block, the difficulty of the proposed procedure and the surgeon's level of expertise.

References:

Peterson, Ellis, Hupp, Tucker. Contemporary oral and maxillofacial surgery. Fourth Ed.2003; p

KRAUT R., CHAHAL O. Management of patients with trigeminal nerve injuries after mandibular implant placement. *J Am Dent Assoc.* 2002: Vol 133 No 10 p1351-1354.

Injection techniques- complications

Which of the following techniques could lead to the following complications: hematoma, trismus, temporary paralysis of cranial nerves III, IV, VI, diplopia, and paralysis of the eye?

1. Posterior superior Alveolar (PSA)
 2. Maxillary Nerve Block (V_2)
 3. Gow-Gates mandibular nerve block
 4. Akinosi technique
 5. Inferior alveolar nerve block
-

answer: 3

Gow-Gates mandibular nerve block (GGMNB) technique/ third division nerve block/ V_3 nerve block.
2% incidence of aspiration, success rate more than 95%

Nerve anesthetized:

1. Inferior alveolar
2. Mental
3. Incisive
4. Lingual
5. Mylohyoid

6. Auriculotemporal
7. Buccal N (in 75% of the patients)

Indications:

1. Multiple procedures on mandibular teeth
2. When buccal soft tissue anesthesia, from the third molar to the midline, is required
3. When lingual soft tissue anesthesia is required
4. When a conventional inferior alveolar nerve block is unsuccessful

Contraindications:

1. Infection or acute inflammation in the area of injection
2. Patients who might bite either their lip or their tongue, such as young children and physically or mentally handicapped adults.
3. Patients who are unable to open their mouth wide.

Advantages:

1. Requires only one injection; a buccal nerve block not usually necessary
2. High success rate (>95%)
3. Minimum aspiration rate
4. Few postinjection complications (i.e. trismus)
5. Provides successful anesthesia where a bifid inferior alveolar nerve and bifid mandibular canals are present.

Disadvantages:

1. Lingual and lower lip anesthesia is uncomfortable for many patients and possibly dangerous for certain individuals
2. The time to onset of anesthesia is somewhat longer (5 min) than with an inferior alveolar nerve block (3-5 min)

Technique:

1. Pt in a supine position with mouth wide open to allow translation of the condyles
2. Intraoral landmarks: injection distal to Max. 2nd molar at height of ML cusp
3. Target area: lateral side of the condylar neck, just below the insertion of the lateral pterygoid muscle
4. Advance until neck of the condyle contacted
5. Aspirate: Maxillary artery inferior to target area
6. Usually just 1.8cc
7. Pt. keep mouth open 1-2 min. after injection

Complications:

hematoma, trismus rare, temporary paralysis of cranial nerves III, IV, VI. Diplopia, paralysis of the eye. If bone is not contacted, do not administer anesthesia.



Which of the following techniques could lead to the following complications: trismus, transient facial paralysis (facial nerve anesthesia) due to anesthesia into the parotid gland with inability to close lower eyelid, and drooping of upper lip on the affected side?

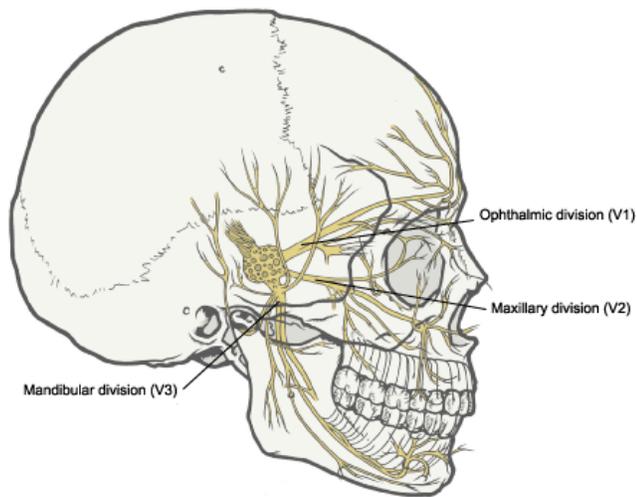
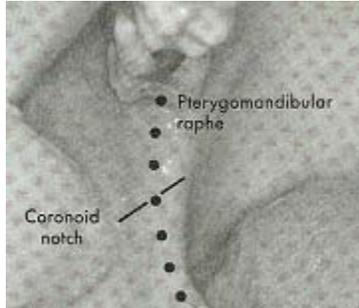
1. Posterior superior Alveolar (PSA)
2. Maxillary Nerve Block (V_2)
3. Gow-Gates mandibular nerve block
4. Akinosi technique
5. Inferior alveolar nerve block

Answer: 5

IANB (Inferior alveolar nerve block):

Pulpal anesthesia of mandibular teeth is traditionally obtained through the inferior alveolar nerve block (IANB). Additionally, anesthesia of the buccal soft tissues and bone anterior to the mental foramen is provided. If anesthesia of the buccal soft tissues overlying the mandibular molars is needed, the buccal nerve must be blocked. The anterior two third of the lingual nerve is usually blocked along with the inferior alveolar nerve, the floor of the mouth, the mucous membrane and mucoperiosteum on the lingual side of the mandible. Failure rate 20%, 10-15% incidence of aspiration.

Complications: hematoma rare, trismus, transient facial paralysis (facial nerve anesthesia) due to anesthesia into the parotid gland with inability to close lower eyelid, and drooping of upper lip on the affected side.



The Trigeminal Nerve Distribution

Anatomy:

Motor fibers of the cranial nerve V (trigeminal N.) supply:

1. Masticatory: masseter, temporalis, pterygoideus medialis, pterygoideus lateralis.
2. mylohyoid
3. anterior belly of the digastric
4. tensor tympani
5. tensor veli palatini

Maxillary Injection Techniques:

Supraperiosteal (infiltration):

Nerves anesthetized: large terminal branches of the dental plexus

Complications: Pain on needle insertion with the needle against the periosteum reinsert.

Posterior superior Alveolar (PSA)

Provides pulpal anesthesia to the three maxillary molars and their overlying buccal soft tissues and bone.

Complications: hematoma, mandibular anest (V₃ is located lateral to the PSA nerves).

Middle Superior Alveolar (MSA)

Maxillary first and secondary pre molars, MB root of the first molar.

Complications: hematoma, apply pressure with sterile gauze over the site for a minimum of 60 seconds.

Anterior Superior Alveolar (ASA)

Provides anesthesia of the maxillary premolars, anterior teeth, and their overlying buccal soft tissues and bone. In addition, the soft tissues of the lower eyelid, lateral portion of the nose, and the upper lip are anesthetized.

Complications: hematoma (rare) may develop across the lower eyelid and the tissues between it and the infratemporal foramen. Apply pressure on the soft tissue over the foramen for 2 to 3 min.

Prevention: apply pressure during and after the ASA nerve block.

Maxillary Nerve Block (V₂):

Greater palatine approach and high tuberosity approach.

Provides anesthesia of the entire maxillary nerve peripheral to the site of injection: pulps of all maxillary teeth on the side of the injection, their overlying buccal soft tissues and bone, palatal hard and soft tissues on the injection side, and the upper lip, cheek, side of the nose, and lower eyelid.

Complications: hematoma primarily with the high tuberosity approach; the greater palatine approach is potentially traumatic, pain.

Greater (anterior) palatine nerve block

Provides anesthesia to both the palatal hard and soft tissues, ranging from the third molar as far anterior as the medial aspect of the first premolar. At the first premolar soft tissue anesthesia may only be partial because of overlay from the nasopalatine nerve. The nasopalatine nerves provide sensory innervation to the hard and soft tissues of the premaxilla as far distal as the first premolar. Greater palatine foramen is most frequently located distal to the Max. 2nd molar.

Technique: contact bone, aspirate, deposit not more than ¼ to 1/3 carpule.

Complications: ischemia and necrosis of soft tissues with highly concentrated vasoconstrictor, hematoma rare.



Nasopalatine Nerve block

Complications: ischemia and necrosis of soft tissues with highly concentrated vasoconstrictor, hematoma rare.

Anterior Middle Superior Alveolar Nerve Block (AMSA) nerve block

Nerves anesthetized: ASA, MSA.

Landmark: Hard palate, contact point between the 1st and 2nd molar.

Needle @ 45^o to the palate

Complications: palatal ulcer due to ischemia and necrosis of soft tissues, unexpected contact with nasopalatine nerve

Local infiltration of the palate:

Complications: ischemia and necrosis of soft tissues with highly concentrated vasoconstrictor.

P-ASA palatal approach-anterior superior alveolar nerve block

Complications: palatal ulcer due to ischemia and necrosis of soft tissues, unexpected contact with nasopalatine nerve.

Maxillary nerve block

Greater palatine approach and high tuberosity approach.

Provides anesthesia of the entire maxillary nerve peripheral to the site of injection: pulps of all maxillary teeth on the side of the injection, their overlying buccal soft tissues and bone, palatal hard and soft tissues on the injection side, and the upper lip, cheek, side of the nose, and lower eyelid.

Complications: hematoma primarily with the high tuberosity approach; the greater palatine approach is potentially traumatic, pain; hematoma if maxillary artery is punctured, penetration of the orbit during greater palatine approach (greater palatine canal approach is usually successful if 2/3 of the needle has advanced into the canal). Periorbital swelling and proptosis, regional block of 7th N. causing diplopia, mydriasis, transient loss of vision with optic nerve block, penetration of nasal cavity.

Mandibular anesthesia:

Buccal nerve block:

Complications: hematoma at the injection site, apply pressure to the area for 3- min. min.

Mental nerve block:

Complications: hematoma, apply pressure to the area of bleeding 2 min. minimum.

Incisive nerve block:

Incisive nerve block: The incisive and mental nerves are terminal branches of the inferior alveolar nerve, arising at the mental foramen. The mental nerve, exiting the mental foramen, provides sensory innervation to the skin of the lower lip and chin regions and the mucous membrane lining the lower lip; the incisive nerve, remaining within the mandibular canal, provides sensory innervation to the pulps of the premolars, canine, incisors, and the bone anterior to the mental foramen.

Akinosi closed-mouth mandibular block/ Akinosi technique/ closed-mouth mandibular nerve block/ tuberosity technique.

Nerves anesthetized:

1. Inferior alveolar
2. Incisive
3. Mental
4. Lingual
5. Mylohyoid

Indications:

1. Limited mandibular opening
2. Multiple procedures on mandibular teeth

Contraindications:

1. Infection or acute inflammation in the area of injection
2. Patient who might bite either their lip or their tongue
3. Inability to visualize or gain access to the lingual aspect of the ramus

Advantages:

1. Relatively atraumatic
2. Patient need not be able to open the mouth
3. Fewer postoperative complications (trismus)
4. *Lower aspiration rate (<10%) that with the inferior alveolar nerve block*
5. Provides successful anesthesia where a bifid inferior alveolar nerve and bifid mandibular canals are present.

Disadvantages:

1. Difficult to visualize the path of the needle and the depth of insertion
2. No bony contact; depth of penetration somewhat arbitrary
3. Potentially traumatic if the needle is too close to the periosteum.

Technique:

Target area:

Landmarks: mucogingival junction of the maxillary third (or second) molar, max. tuberosity, coronoid notch on the mandibular ramus
Bevel away from the bone toward the midline
Patient in a supine position, in occlusion
Barrel of the syringe parallel to the maxillary occlusal plane, needle at the level of mucogingival junction of the maxillary third (or second) molar.
Penetration 25mm into the tissue measured from the max. tuberosity

Complications:

hematoma (less than 10%), trismus rare, transient facial nerve (VII) paralysis due to overinsertion and deposition of anesthetic into the parotid gland.



Supplemental Injection Techniques:

Intraosseous Anesthesia:

Complications: palpitation, Postinjection pain, fistula formation at the site of perforation, separation of the perforator, or cannula, perforation of the lingual plate of bone.

Ex. Stabident, Alternative Stabident System (guide sleeve remain in bone)

PDL, intraligamentary:

Indications:

when isolated areas of inadequate anesthesia are present. It may also be used alone to achieve pulpal anesthesia in a single tooth. Although the PDL injection may be used on any tooth, its primary importance lies with mandibular molars, when no nerve block technique has proven to be effective. Advantage to the use of the PDL injection in this way include adequate pulpal anesthesia with a minimal volume of anesthetic (0.2 to 0.4 ml) and the absence of lingual and lower lip anesthesia.

Technique:

A 27-gauge short or 30-gauge ultrashort needle is firmly placed into the periodontal space between the root of the tooth and the interseptal bone.

Although bevel orientation is of little significance in the PDL injection, the author recommends the bevel face the root of the tooth. A volume of 0.2 ml of anesthetic is slowly deposited on each root of the tooth. Successful PDL injection anesthesia is indicated by (1) the presence of resistance to anesthetic deposition and (2) ischemia (whitening) of the soft tissues in the immediate area on injection of the anesthetic.

Contraindication:

presence of infection or inflammation in the areas of needle insertion. This might prove a significant impediment in endodontics, where periapical infection exists or where periodontal infection is present. It is also contraindicated with primary teeth, where permanent tooth bud is present.

Intrapulpal injection:

Complications:

discomfort during injection, within a second tissue is anesthetized.

Intraseptal

Complications: post-injection pain unlikely

Ref: Handbook of Local Anesthesia by Malamed, 5th Ed. Chapters: 12, 13, 14

French Army Surgeon Rene LeFort (1869-1951) in 1901 devised a classification system for fractures of the face. From the following list of choices, choose which one (s) are true concerning the Lefort classification system.

- a. To be classified as a LeFort Fracture the pterygoid plates must be involved.
- b. Lefort I, II and III fractures comprise 60% of all midface fractures.
- c. The LeFort II, or transmaxillary fracture runs between the maxillary floor and the orbital floor. It may involve the medial and lateral walls of the maxillary sinuses and invariably involves the pterygoid processes of the sphenoid.

- d. The LeFort II occurs along yet another weak zone in the face, and is sometimes called a pyramidal fracture because of its shape. A common mechanism is a downward blow to the nasal area.
- e. The Lefort III fracture is also referred to as craniofacial disassociation.

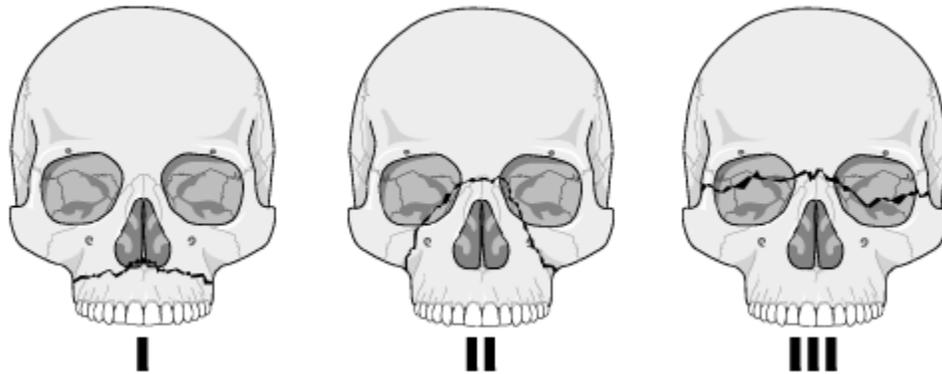
- A. A, B & D
 B. A, C & E
 C. B & E
 D. A, D & E
 E. A & D

Answer is D. A, D & E

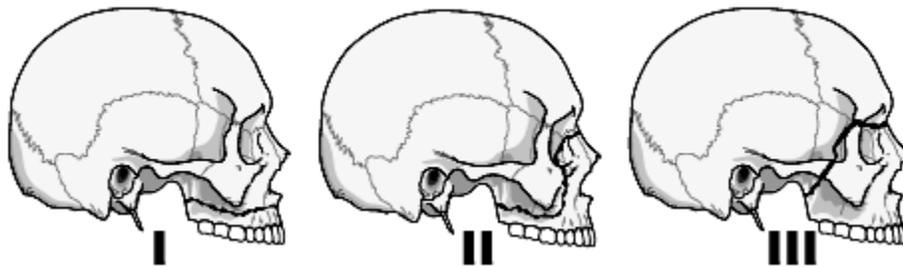
Fracture Type		Prevalence
Zygomaticomaxillary complex (tripod fracture)		40 %
LeFort	I	15 %
	II	10 %
	III	10 %
Zygomatic arch		10 %
Alveolar process of maxilla		5 %
Smash fractures		5 %
Other		5 %

The next set of fractures in this rogue's gallery of common facial fractures are the LeFort complexes. These are complex bilateral fractures associated with a large unstable fragment ("floating face") and **invariably involve the pterygoid plates**. Legend has it that LeFort dropped skulls off of a French tavern roof and analyzed the resulting fracture patterns. This certainly sounds like the kind of study that we would all like to do, even without NIH funding. In reality, LeFort studied fracture patterns produced in cadavers. He found three main planes of "weakness" in the face, which correspond to where

fractures often occur: the transmaxillary plane, the subzygomatic or pyramidal plane (this is really two planes with an apex up at the bridge of the nose), and a craniofacial plane.



frontal views of LeFort complex fractures I - III



lateral views of LeFort complex fractures I - III

The LeFort I, or transmaxillary fracture runs between the maxillary floor and the orbital floor. It may involve the medial and lateral walls of the maxillary sinuses and invariably involves the pterygoid processes of the sphenoid. Clinically, the floating fragment will be the lower maxilla with the maxillary teeth.

The LeFort II occurs along yet another weak zone in the face, and is sometimes called a pyramidal fracture because of its shape. A common mechanism is a downward blow to the nasal area.

The most severe of the classic LeFort fracture complexes is the **LeFort III**. I suppose that this is pretty obvious, given a three-part grading system. In this case, the large unstable (floating) fragment is virtually the entire face! Thus, **this fracture is also referred to as craniofacial disassociation.** This is a very severe injury, and is often associated with significant injury to many of the soft tissue structures along the fracture lines. Generally, considerable force is necessary to produce this injury, and it is uncommon as an isolated injury. It may also occur in association with severe skull and brain injuries.

With the exception of the LeFort I injury, "pure" LeFort injuries are not commonly seen. More commonly seen are variants of the LeFort classification. One of the most common

of these is the LeFort II - tripod fracture complex. This complex is usually due to the large forces encountered in a motor vehicle accident. LeFort was probably unable to apply this much force to the cadaver faces in his study, and it is therefore not too mysterious why he didn't describe these more complex injuries. When describing these injuries, one should probably give a separate diagnosis to each half of the face. Even more complex patterns may be encountered, such as a mixed LeFort II/LeFort III complex or a LeFort III/LeFort II/tripod complex.

Besides the classic LeFort patterns and the mixed LeFort variants, there is another common pattern which is called, for obvious reasons, a "smash" fracture. In these injuries, severe comminution of the face is present, and underlying skull injury is likely. These patients are often in unstable condition with associated axial and appendicular skeletal injuries as well. This category includes several varieties of otherwise unclassifiable fractures, which are named for the portion of the face primarily involved. Subclassifications of smash fractures include the frontal, naso-frontal (naso-ethmoid) or central facial smash syndromes. CT is mandatory for adequately displaying all of the bony and soft tissue components of these injuries.

References:

Dolan KD, Jacoby CG, Smoker WR. The radiology of facial fractures. *Radiographics* 1984;4:575-663.

Peterson LJ, et al. *Contemporary oral and maxillofacial surgery*. 1990, 24:606-07

In the proper management regimen for a maxillary sinus perforation all of the following are true except?

- a. Management of a perforated sinus depends on the size of the defect.
- b. For small defects Gelfoam can be placed over the defect and secured with a figure-8 suture to limit the communication of the sinus with the oral cavity.
- c. Large defects will require primary closure using a buccal or palatal soft-tissue flap.
- d. Antibiotics such as Amoxicillin can be prescribed if there is evidence of acute or chronic sinusitis in the patient's history.
- e. Analgesics and nasal decongestants such as Sudafed can be prescribed as needed.

A. B & C

- B. C & D
- C. A & D
- D. C & E
- E. B & D

The answer is: E B & D

Sinus Perforations:

The maxillary sinus is a potential source of complication during the extractions of upper molars. The floor of the sinus is usually the closest to the palatal root of the upper first molars. The floor of the sinus may be so close to the roots that part of it can be removed with the tooth during routine extractions. Other times the sinus can be easily perforated during traumatic retrieval of broken root tips. One easy way to test for sinus perforations is to squeeze close the patient's nostrils, then ask the patient to breathe out through their nose with their mouth wide open. If the sinus is perforated, air will leak from the nasal passage through the sinus into the oral cavity. Using indirect vision with the help of a mouth mirror, one would see bloody air bubbles. However, this test should only be limited to the initial evaluation of sinus perforation and should not be encouraged in the post-operative course.

Management of a perforated sinus depends on the size of the defect. Patients are informed of the complication and instructed about sinus precautions. Patients are advised against creating suction by smoking or sucking on straws. Heavy sneezing or forcefully blowing the nose should be suppressed. **Analgesics and nasal decongestants such as Sudafed can be prescribed as needed. Antibiotics such as Augmentin can be prescribed if there is evidence of acute or chronic sinusitis in the patient's history.** Small defects (<2mm) are usually left alone and should heal up without any surgical intervention.

For **medium defects (2-6mm), Gelfoam can be placed over the defect and secured with a figure-8 suture to limit the communication of the sinus with the oral cavity.**

Large defects (>6mm) will require primary closure using a buccal or palatal soft-tissue flap. Failure to close a large sinus perforation can result in the formation of oro-antral fistula.

References:

Bach, TL, Woo I. Management of complications of dental extractions, CE offered through Academy of Dental Therapeutics and Stomatology. 2005 pg 5.

Peterson LJ, et al. Contemporary oral and maxillofacial surgery. 1990, 473-482.

In a pyramidal (LeFort II) fracture which of the following is not routinely involved?

- a. Frontal process of the maxilla
- b. Vomer

- c. Lacrimal bones
- d. Inferior orbital floor and rim
- e. across the pterygomaxillary fissure, and through the pterygoid plates

Answer is: B

Le Fort II fractures (pyramidal) may result from a blow to the lower or mid maxilla. Such a fracture has a pyramidal shape and extends from the nasal bridge at or below the nasofrontal suture through the **frontal processes of the maxilla**, inferolaterally through the **lacrimal bones** and **inferior orbital floor and rim** through or near the inferior orbital foramen, and inferiorly through the anterior wall of the maxillary sinus; it then travels under the zygoma, **across the pterygomaxillary fissure, and through the pterygoid plates**

References:

Dolan KD, Jacoby CG, Smoker WR. The radiology of facial fractures. Radiographics 1984;4:575-663.

Which of the following are considered direct radiographic signs of facial fractures?

- a. Fluid in paranasal sinus
 - b. Cortical defect or diastatic suture
 - c. Soft tissue swelling
 - d. Asymmetry of face
 - e. Bone fragments overlapping causing a “double-density”
-
- A. a, b & c
 - B. b, d & e
 - C. b, c & d
 - D. a, c & e
 - E. c, d & e

The answer is: B b, d & e

Radiographic signs of facial fractures

- **Direct Signs**
 - nonanatomic linear lucencies
 - cortical defect or diastatic suture

- bone fragments overlapping causing a "double-density"
- asymmetry of face
- **Indirect Signs**
 - soft tissue swelling
 - periorbital or intracranial air
 - fluid in a paranasal sinus

References:

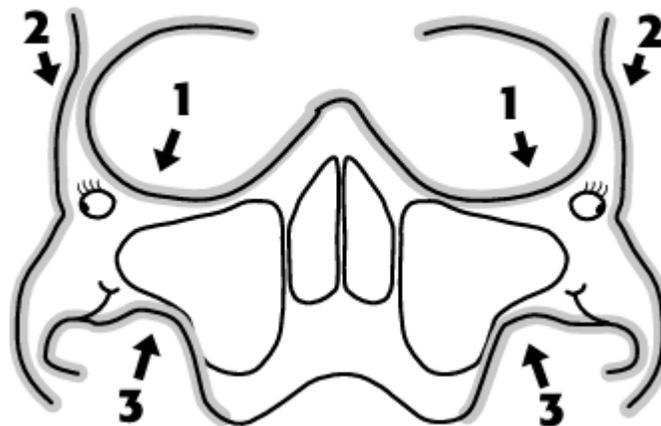
Peterson LJ, et al. Contemporary oral and maxillofacial surgery. 1990, 591-594.

True or False

The lines of Dolan are three anatomic contours best seen on the Caldwell view of the face. Lee Rogers pointed out that the 2nd and 3rd lines together form the profile of an elephant.

- a. Both statements are true
- b. Both statements are false
- c. First is true and the second false
- d. First is false and the second is true

The answer is: D First is false and the second is true



the lines of Dolan and the elephants of Rogers

What are the lines of Dolan? They are three anatomic contours **best seen on the Waters view of the face,** and they were first popularized by Dolan et al. As you can see, the 3 lines of Dolan lead the eye along some facially important structures. **Lee Rogers pointed out that the 2nd and 3rd lines together form the profile of an elephant.**

References:

1. Richardson ML, Approaches To Differential Diagnosis In Musculoskeletal Imaging, Review Of Dolan papers, 2000.
2. Dolan KD, Jacoby CG. Facial fractures. Semin Roentgenol 1978;13:37-51.
3. Dolan KD, Jacoby CG, Smoker WR. The radiology of facial fractures. Radiographics 1984;4:575-663.

Which of the following are true concerning Battle's sign?

- A. Always occurs with-in the first 30 minutes of trauma
- B. Consists of bilateral circumorbital ecchymoses, nasal epistaxis and CSF rhinorrhea and indicates a skull fracture in the anterior fossa .
- C. Consists of bruising around the mastoid process and may indicate a middle fossa skull fracture or leakage of blood from a condylar fracture or trauma to the auditory canal
- D. Occurs from blast damage that causes rapid expansion of gas in internal hollow organs

Answer: C

Battle's sign is bruising over the post-auricular and mastoid area. It usually indicates a base of skull fracture, and may take some hours before becoming evident. It can also occur from seepage of blood from a condylar fracture or damage to the auditory canal, and these should be considered if other causes are ruled out. A trauma patient may also demonstrate a more anterior fracture and can have Battle's sign and "raccoon eyes" and other signs and symptoms of an anterior fracture to the base of the skull.



Note: The term “Battle’s sign” is named after a person named Battle, not because it often occurs due to trauma such as one might see in a battle...

Booth, Eppley and Schmelzeisen, Maxillofacial Trauma and Esthetic Facial Reconstruction, Copyright 2003, Churchill Livingstone, Philadelphia, PA., pp. 39,40,56,82 and 201.

Photo from www.immediateactionservices.com

Which of the following are true concerning chlorhexidine?

- a. More effective against gram-positive than gram-negative bacteria
- b. Has little effect on bacterial counts
- c. Accumulates on the skin and has an anti-bacterial effect after the wash
- d. Should not be used in combination with iodoform preps

Answer:

A and c....

Both chlorhexidine and hexachlorophene are effective against Gram-positive bacteria and have a cumulative effect when used through-out the day. However, chlorhexidine has found more wide-spread use because of the potential for systemic toxicity with repeated use of hexachlorophene. As a pre-surgical rinse, chlorhexidine rinses have been shown to decrease bacterial load and help prevent post-operative infection.

Peterson et al, Contemporary Oral and Maxillofacial Surgery, 3rd edition, Copyright 19978 by Mosby-Year Book, inc.

Which of the following describe a teratoma?

- a. A developmental tumor composed of tissue from ectoderm only
- b. Originate form germ cells that can produce multiple types of tissue sometimes arranged in a disorganized manner.
- c. Are always benign
- d. Can produce teeth in non-oral areas.

Answer:

B and d

By definition, a teratoma should consist of a tumor composed of tissue from all three germ layers: ectoderm, mesoderm and endoderm. These types of malformations show a spectrum of complexity and most commonly occur in the testes or ovaries. They can produce well-formed teeth or even parts of jaws. Teratomas can be either benign or malignant.

Dermoid cysts do not contain tissue from all three germ layers; however, they are similar and many people consider them to be a type of teratoma. They usually present as a doughy or rubbery slow-growing mass that may exhibit pitting. Histologically, they consist of fibrous connective tissue containing one or more skin appendages such as sebaceous glands, hair follicles or sweat glands. They often contain abundant keratin in the cyst lumen.

Neville and Dam, p. 30-31, Oral and Maxillofacial Pathology, Copyright 1995by W.B. Saunders Company, Philadelphia, PA

Which of the following syndromes involve multiple hamartomas?

- a. Gorlin's Syndrome
- b. Cowden's Syndrome
- c. Cleidocranial dysplasia
- d. Gardner's Syndrome

Answer:

- b. Cowden's Syndrome, also known as Multiple Hamartoma Syndrome.

A hamartoma is a malformation presenting as a mass of disorganized tissue indigenous to the particular site. Examples are mature but disorganized hepatic cells, blood vessels and even bile ducts within the liver that may even produce bile that does not go anywhere. (p. 74, Kumer, Calvin, Robbins, Basic Pathology, 5th ed., 1992, W.B. Saunders Company, Philadelphia)

Cowden's Syndrome is an autosomal dominant trait that presents as small papules primarily on facial skin especially around the mouth, ears and nose. Patients often have trichilemmomas (papules resembling hair follicles), cutaneous hemangiomas, xanthomas and lipomas and acral keratosis. Other diseases sometimes associated with this syndrome involve the thyroid (goiter or a thyroid adenoma), follicular adenocarcinoma, fibrocystic disease of the breast with breast cancer in 20-30% of these cases developing at an early mean age (40) and either benign or malignant tumors of the female genitourinary tract. Diagnosis is based on 2 of the following 3:

- Multiple facial trichilemmomas
- Multiple oral papules
- Acral Keratosis

(Neville and Damm, 2nd ed, 2002, p. 659-660 WB Saunders Co.)

Match the fascial space on the right with the most appropriate description to the left. Some answers may be used more than once, and some not at all.

- | | |
|--|--------------------------------|
| ___ Involved when an infection erodes the lingual surface of the mandible inferior to the attachment of the mylohyoid muscle. | A. Canine space. |
| ___ Bound medially by the fascia of the medial pterygoid muscle and laterally by the ramus of the mandible. | B. Buccal space. |
| ___ Bound anteriorly by the investing fascia of the superior pharyngeal constrictor muscle and posteriorly by the alar fascia. | C. Infratemporal space. |
| ___ Infection here obliterates the nasolabial fold. | D. Submental space. |
| ___ Involved when a maxillary molar erodes the buccal plate superior to the attachment of the buccinator muscle. | E. Submandibular space. |
| ___ Located between the anterior bellies of the | F. Sublingual space. |
| | G. Masseteric space. |
| | H. Pterygomandibular space. |
| | I. Superficial temporal space. |
| | J. Deep temporal space. |

- digastric muscle and the mylohyoid muscle.
- ___ Infection here causes minimal swelling extraorally, but notable swelling in the floor of the mouth.
- ___ The mandibular third molar is the most common primary cause of infection of this space.
- ___ These three spaces are involved bilaterally in Ludwig's angina.
- ___ This space is the gateway to other fascial spaces of the neck.
- ___ Infection here may progress inferiorly to the level of the postero-superior mediastinum.
- ___ This space contains the carotid sheath in its posterior extension and extends antero-medially to the superior pharyngeal constrictor muscle.
- K. Lateral pharyngeal space.
- L. Retropharyngeal space.
- M. Prevertebral space.

ANSWERS:

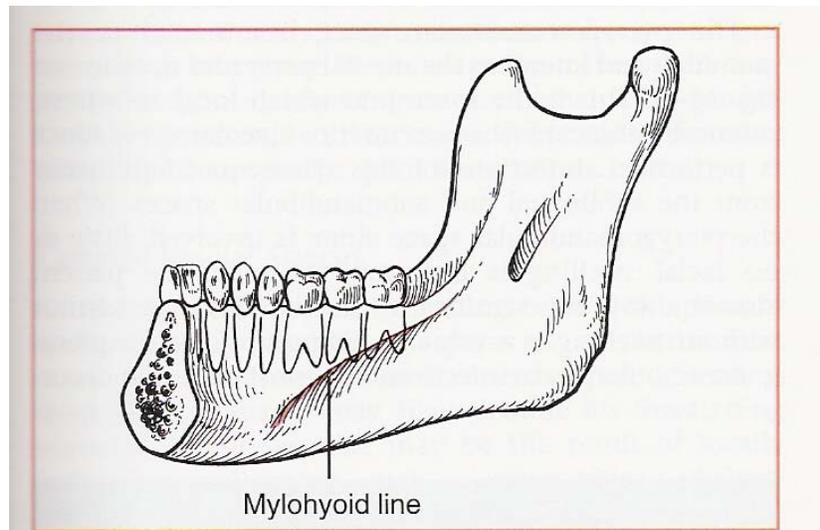
In general, most odontogenic infections are mild and are easily treated by the administration of antibiotics or local surgery (I&D or extraction). Many times, infections will develop **vestibular swellings/abscesses (ie: buccal/palatal abscess)**; fascial spaces become involved only when bone is eroded in certain areas relative to muscle attachments. Keep in mind that bone will always erode the thinnest area. In healthy patients, fascial spaces are not spaces – they become distended only when infectious material spreads into them, so they are usually only potential spaces.

- ___ Involved when an infection erodes the lingual surface of the mandible inferior to the attachment of the mylohyoid muscle.

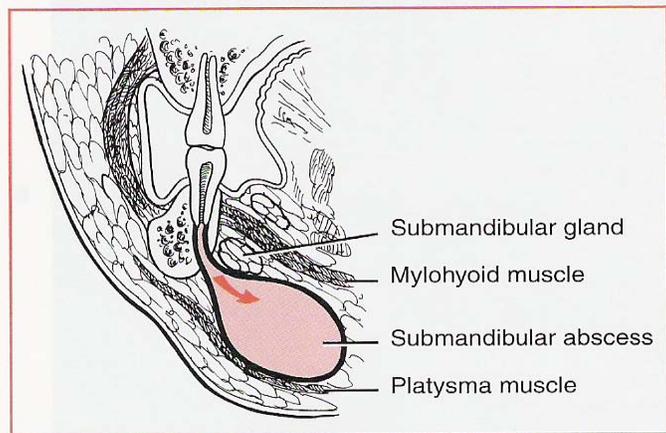
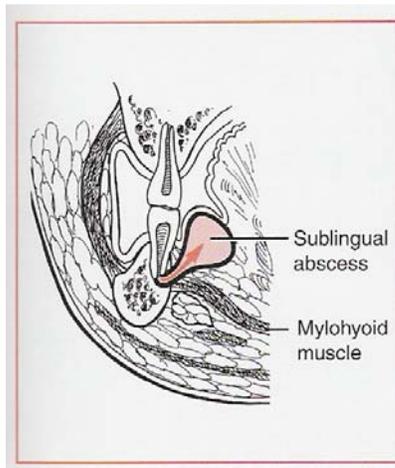
E. Submandibular space.

The **submandibular space** is bound laterally by the medial border of the mandible, inferiorly by overlying skin, and supero-medially by the inferior surface of the mylohyoid muscle. It is involved by erosion of the lingual cortex of the mandible inferior to the mylohyoid line (where the associated muscle attaches). If the infection erodes superior to this point, the **sublingual space** will be involved (also known as the paralingual space). It is bound superiorly by the oral mucosa of the floor of the mouth and inferiorly by the superior mylohyoid muscle. Again, the medial border of the mandible is the lateral boundary. The sublingual space is usually involved by infections from the premolars and first molar. The submandibular space is most commonly involved by infection of the

third molar. The second molar may involve either space depending on where the apex is located relative to the muscle attachment. Infection from either of these spaces may extend posteriorly and involve the **masseteric space** or **pterygomandibular space**.



Peterson LJ, et al. *Contemporary oral and maxillofacial surgery*, 4th Ed. Mosby, Inc. 2003

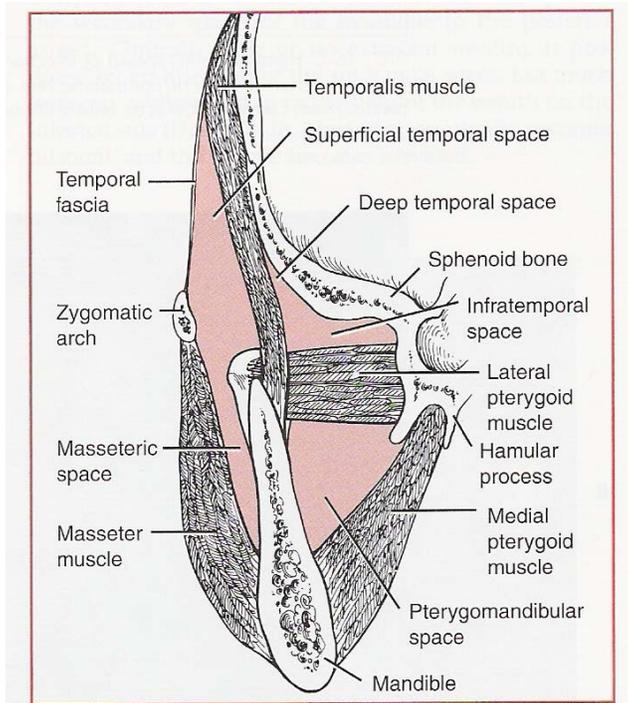


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— Bound medially by the fascia of the medial pterygoid muscle and laterally by the ramus of the mandible. **H. Pterygomandibular space.**

The **pterygomandibular space** is located between the mandible and the medial pterygoid muscle. This is the location where local anesthetic solution is deposited when performing an inferior alveolar nerve block. Infection of this space is characterized by significant trismus due to the proximity of the medial pterygoid muscle. If this is the only space involved, little swelling will be evident. So trismus without swelling → pterygomandibular space infection. Infection here occurs most commonly when a needle tract infection occurs after administering

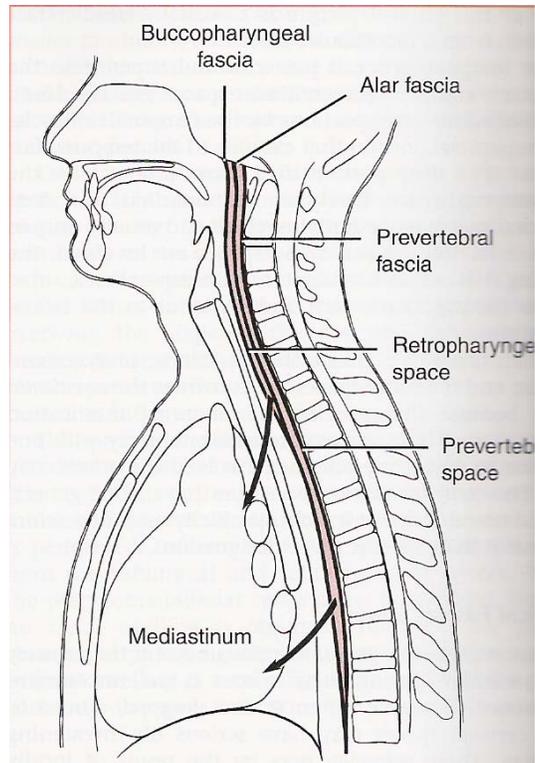
an IAN block. Infections from the sublingual and submandibular spaces can communicate posteriorly to this space.



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— Bound anteriorly by the investing fascia of the superior pharyngeal constrictor muscle and posteriorly by the alar fascia. **L. Retropharyngeal space.**

The **retropharyngeal space** is located posterior the pharynx and posteriorly by the alar fascia. It begins at the base of the skull and extends inferiorly to the level of the C7 or T1 vertebra where it fuses in its anterior aspect with the buccopharyngeal fascia. Because this is its inferior extent, infections can only reach the posterosuperior mediastinum when this space is involved. The major risk of infection here is that this space is adjacent to the **prevertebral space** which similarly extends from the base of the skull (at the pharyngeal tubercle), but reaches inferiorly to the diaphragm. The boundary between these two spaces is the alar fascia. This latter space is directly adjacent to the vertebral column. If either of these spaces is involved, the patient will be seriously ill and at risk of 1. upper airway obstruction, 2. rupture of a retropharyngeal space abscess with aspiration of pus into the lungs and asphyxiation, and 3. spread of infection into the mediastinum and thorax.



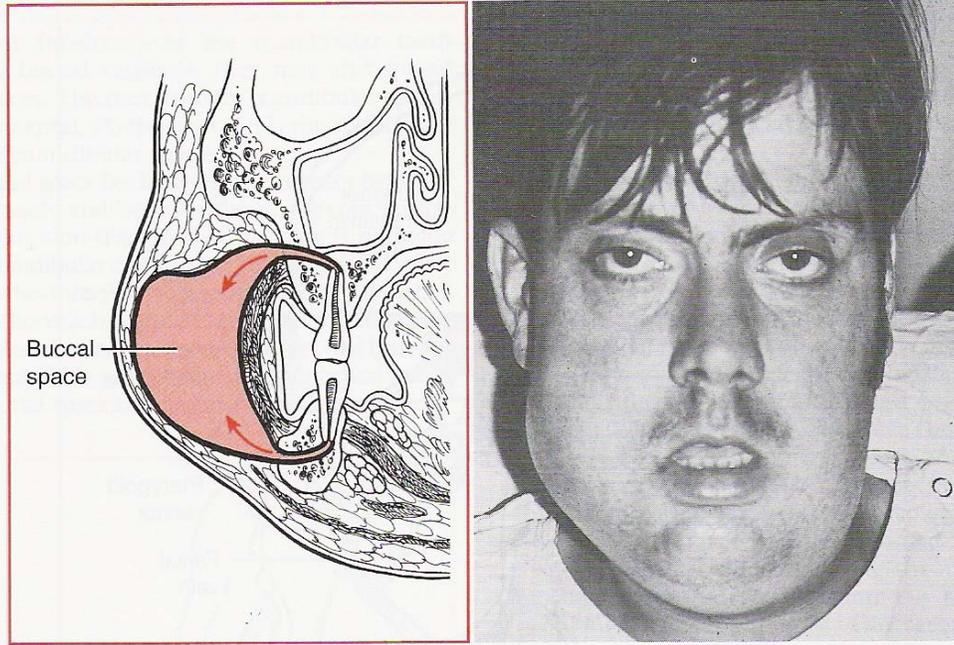
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— Infection here obliterates the nasolabial fold. **A. Canine space.**

An infection of the **canine space** occurs exclusively when the maxillary canine is involved as this is the only tooth with a root long enough to reach this space. The space lies between the levator anguli oris and levator labii superioris muscles. Infection is characterized by obliteration of the nasolabial fold and may drain just inferior to the medial canthus of the eye.

— Involved when a maxillary molar erodes the buccal plate superior to the attachment of the buccinator muscle. **B. Buccal space.**

The **buccal space** lies between the skin and the lateral surface of the buccinator muscle. It may become involved due to infections of either the maxillary or mandibular teeth; it is most commonly involved by maxillary molars. In this case, the maxilla is eroded buccally superior to the attachment of the buccinator muscle. When it is involved due to a mandibular infection, the erosion of bone takes place inferior to the attachment of the muscle. Swelling in this case will be inferior to the zygomatic arch and superior to the inferior border of the mandible. In this case, both of these landmarks will remain readily palpable.

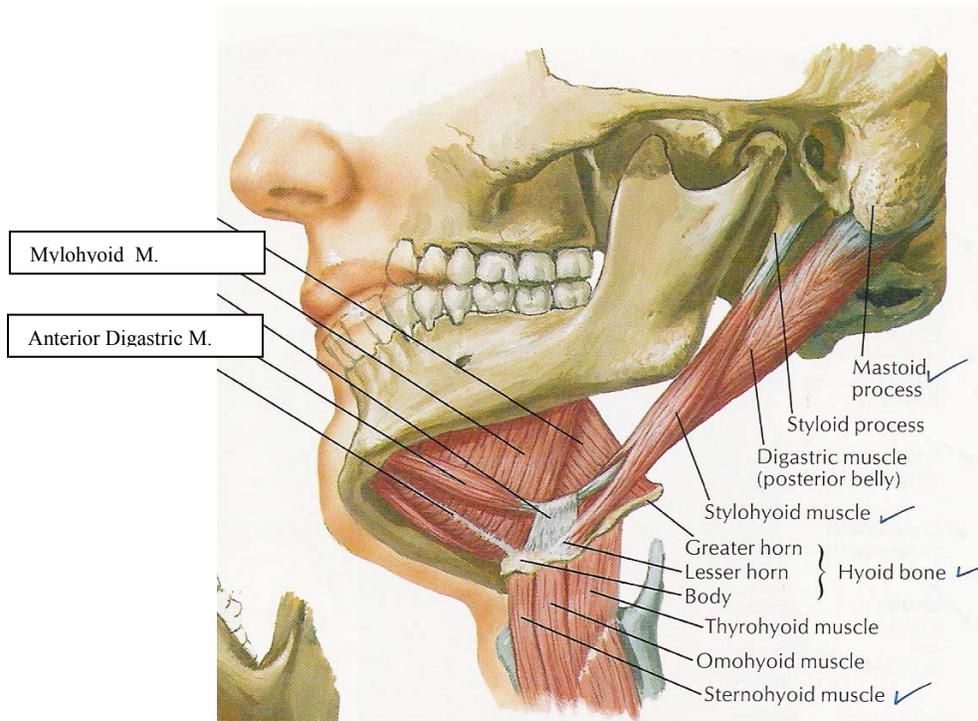


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— Located between the anterior bellies of the digastric muscle and the mylohyoid muscle.

D. Submental space.

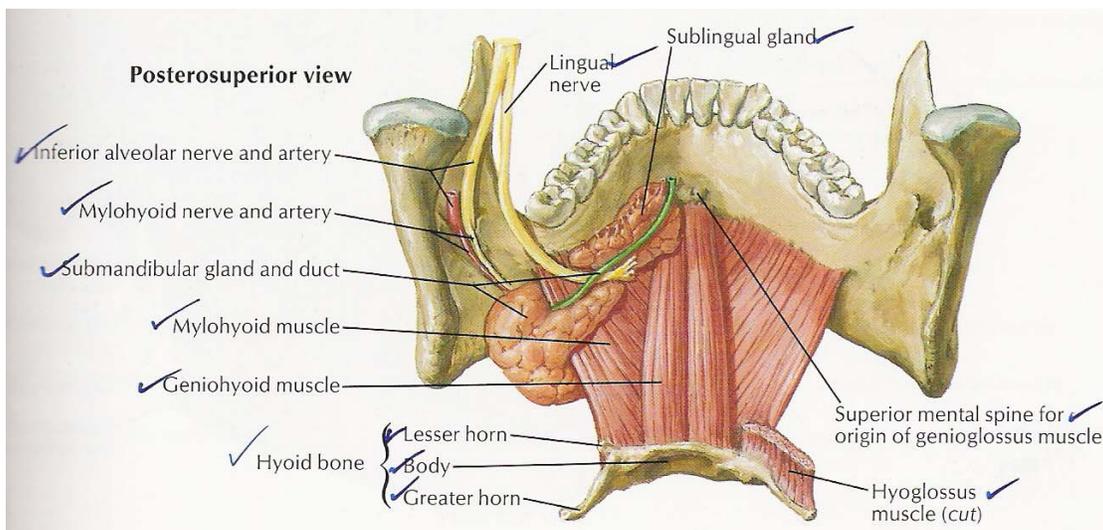
The **submental space** lies between the anterior bellies of the digastric muscle, is bound superiorly by the mylohyoid muscle and inferiorly by the overlying skin. The teeth that most commonly involve this space are the mandibular incisors. Erosion of bone occurs facially and inferior to the attachment of the mentalis muscle. The infection then proceeds inferiorly.



Adapted from: Netter FH, M.D. *Atlas of human anatomy*. 3rd Ed. ICON learning systems. 2003.

— Infection here causes minimal swelling extraorally, but notable swelling in the floor of the mouth. **F. Sublingual space.**

As it is bound inferiorly by the mylohyoid muscle, infection of the **sublingual space** will cause little extraoral swelling; distension of tissues occurs intraorally and the floor of the mouth will be raised notably on clinical examination.



Adapted from: Netter FH, M.D. *Atlas of human anatomy*. 3rd Ed. ICON learning systems. 2003.

— The mandibular third molar is the most common primary cause of infection of this space. **E. Submandibular space.** (see above).

— These three spaces are involved bilaterally in Ludwig's angina.

D. Submental space.

E. Submandibular space.

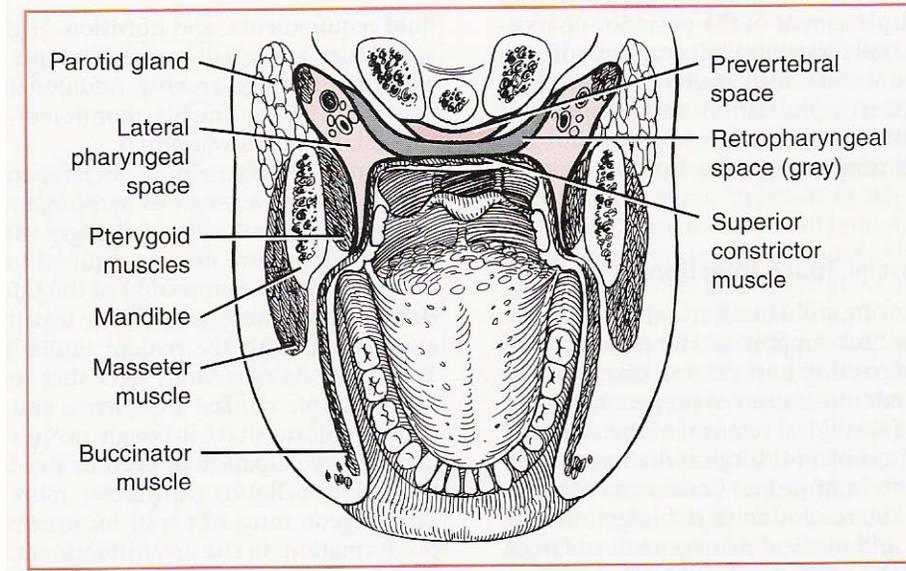
F. Sublingual space.

Ludwig's angina is characterized by elevation and displacement of the tongue and tense, hard induration of the submandibular region superior to the hyoid bone. This occurs due to bilateral involvement of the above fascial spaces bilaterally. Patients exhibit drooling, trismus and dysphagia. This is medical emergency and the patient should be hospitalized immediately due to the risk of airway obstruction and the fact that this infection usually progresses rapidly. Treatment is with aggressive I&D +/- extraction(s), aggressive IV antibiotics, and careful management of the airway.

— This space is the gateway to other fascial spaces of the neck.

K. Lateral pharyngeal space.

The **lateral pharyngeal space** becomes involved secondarily – it is never the first fascial space involved. It is most commonly involved when a **pterygomandibular space** infection extends posteriorly. This space is bound by the base of the skull superiorly, and the hyoid bone inferiorly; it lies medial to the medial pterygoid muscle and lateral to the superior pharyngeal constrictor muscle; its anterior border is the pterygomandibular raphe. Posteriorly, it borders the alar and prevertebral fascia, and may allow spread of infections to the **retropharyngeal space** and **prevertebral space**.



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Contents of this space include the styloid process and associated muscles and fascia. They separate the anterior portion of the space (containing muscles) from the posterior aspect that contains the carotid sheath and its contents (carotid artery, internal jugular vein and vagus [X] nerve). Infections of this space are characterized by severe trismus, lateral swelling of the neck and inferior angle of the mandible, and swelling of the lateral pharyngeal wall intraorally toward the midline. Fever and dysphagia are also routinely observed. In addition to the spread of infection to the spaces listed above, other complications of an infection here may include thrombosis of the internal jugular vein, erosion into the carotid artery or its branches and interference with cranial nerves IX-XII.

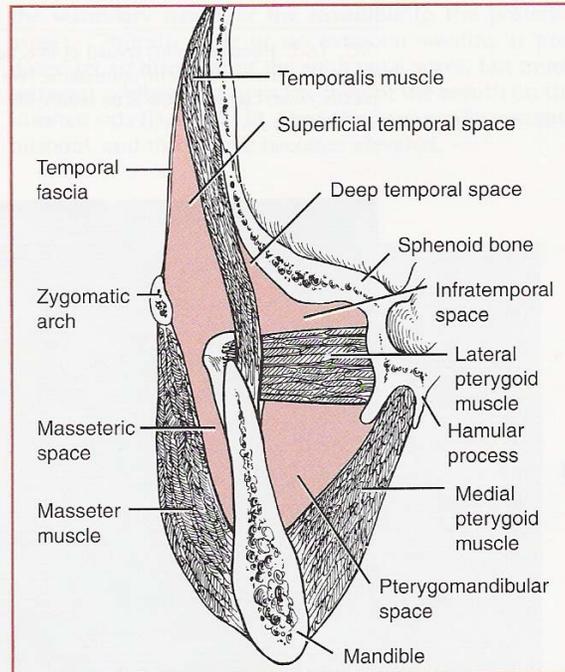
___ Infection here may progress inferiorly to the level of the posterosuperior mediastinum.

L. Retropharyngeal space. (see above).

___ This space contains the carotid sheath in its posterior extension and extends antero-medially to the superior pharyngeal constrictor muscle.

K. Lateral pharyngeal space.

The **infratemporal space** is located posterior to the maxilla, bound medially by the lateral pterygoid plate of the pterygoid process of the sphenoid bone, and superiorly by the base of the skull. Laterally, it is continuous with the **superficial and deep temporal spaces**. If involved, these spaces are infected by a maxillary third molar. The latter two spaces are separated by the body of the temporalis muscle; the **superficial temporal space** is additionally bound the overlying skin and the **deep temporal space** by the skull. The temporal spaces are rarely involved by infections.



Peterson LJ, et al. *Contemporary oral and maxillofacial surgery*, 4th Ed. Mosby, Inc. 2003

The **masseteric space** lies between the lateral aspect of the mandible and the masseter muscle. It is usually involved by spread from the buccal space or a soft tissue infection around the mandibular third molar. It is characterized by trismus and swelling of the angle of the jaw and ramus.

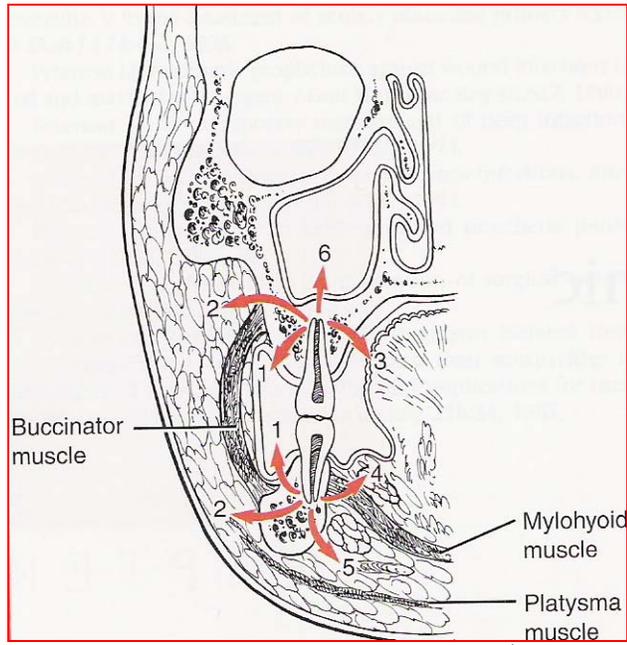
The **masticator space** refers collectively to the **masseteric, pterygomandibular** and **superficial and deep temporal spaces**. These spaces are all linked through fascial spaces and communicate easily with one another. The term, however, refers to a diffuse collection of spaces and isn't as useful clinically as referring to a specific space.

Maxillary infections may spread superiorly and cause orbital cellulitis or even cavernous sinus thrombosis. Both of these conditions are extremely serious and require immediate treatment. Since the veins of the face do not have valves, these infections may spread very rapidly.

References:

- Netter FH, M.D. *Atlas of human anatomy*. 3rd Ed. ICON learning systems. 2003.
- Peterson LJ, et al. *Contemporary oral and maxillofacial surgery*, 4th Ed. Mosby, Inc. 2003. pp. 367-375.

-
1. List the fascial space/area affected by the numbers 1-6 in the following diagram. (this is not a board-type question, but is included to reinforce the above material)



Peterson LJ, et al. *Contemporary oral and maxillofacial surgery*, 4th Ed. Mosby, Inc. 2003

- Answers:**
1. Vestibular abscess.
 2. Buccal space.
 3. Palatal abscess.
 4. Sublingual space.
 5. Submandibular space.
 6. Maxillary sinus.

References:

- Netter FH, M.D. *Atlas of human anatomy*. 3rd Ed. ICON learning systems. 2003.
- Peterson LJ, et al. *Contemporary oral and maxillofacial surgery*, 4th Ed. Mosby, Inc. 2003. pp. 367-375.

**An elevator can function as which of the following simple machines?
Select all that apply.**

- A. Inclined plane.
- B. Lever.
- C. Pulley.

- D. Screw
- E. Wedge.
- F. Wheel and axle.

Answer: **B. Lever.**
 E. Wedge.
 F. Wheel and axle.

Elevators facilitate the process of extracting teeth and should be used with several different techniques to optimize operator performance. They can function as first class levers (load is located at the opposite end from the applied force with the fulcrum in the middle) when placed into a purchase point and pivoted against the alveolar bone. They can also be used as a wedge to expand the alveolus and facilitate more apical purchase of the forceps. In the case of a broken root tip during extraction of a mandibular molar, a triangular (Cryer) elevator can be used in a rotating manner to deliver the remainder of the root as a wheel and axle.

Elevators cannot be used as inclined planes, pulleys or screws.

Reference:

- Peterson LJ, *et al.* *Contemporary oral and maxillofacial surgery*, 4th Ed. Mosby, Inc. 2003. pp. 130-133.

It is acceptable to ground the patient during electrosurgery by placing the ground electrode on the dental chair.

- A. True.
- B. False.

Answer: B. False.

Electrosurgery works by flowing an electrical current from a generator through a small cutting electrode at the point of surgery and back to the generator via a ground electrode. The current through the circuit is the same throughout, and cutting occurs at the cutting electrode because of its small size and high current density. It is recommended that the ground electrode should have a large surface area in contact with the patient – this prevents additional burns/surgery from occurring at the site of grounding. Many practitioners ground the patient beneath the back, but some authors recommend that grounding be done below the thigh as no bony protuberances are present there (ie: vertebra or shoulder blade). Ensure patients do not have keys or other metal objects in their pockets if you use this technique.

A dentist should not attempt to ground the chair by placing the ground electrode on it to avoid the need to ground individual patients. When this is done, patient contact with metal parts of the chair can cause burns.

Reference:

- Schillingburg HT, *et al. Fundamentals of fixed prosthodontics*, 3rd Ed. Quintessence Publishing Co, Inc. 1997. pp. 269-272.

Which two of the following skull films can be used to visualize a zygomatico-maxillary complex (ZMC) fracture?

- A. Postero-anterior projection.
- B. Lateral cephalogram.
- C. Waters' projection.
- D. Reverse-Towne's projection.
- E. Submentovertex projection.

**Answer: C. Waters' projection.
E. Submentovertex projection.**

The **Waters' projection** is also known as an occipitomenal projection. It is a variation of the postero-anterior projection where the head is tipped backward. Structures visualized include the frontal and ethmoid sinuses, orbits, zygomatico-maxillary complex and nasal cavity. The coronoid process can also be seen between the maxilla and zygomatic arch.

The **submentovertex projection** shows the base of the skull, position and orientation of the condyles, sphenoid sinuses, curvature of the mandible, lateral wall of the maxillary sinuses and displacement of a zygomatic arch fracture. The top of the patient's head is placed against the film and the x-ray beam passes thorough the submental area and then through the rest of the head. This is also called the "jug-handle" view.

The **postero-anterior projection** shows the entire head in this plane. It is used primarily to examine the skull for disease, trauma, or developmental abnormalities. You can also detect medio-lateral changes in the skull. Although it can be used to evaluate trauma, it does not provide good visualization of the ZMC. It provides a good view of the frontal and ethmoid sinuses, nasal fossae and orbits.

The **lateral cephalogram** can be used to survey for the same purposes. It is used in orthodontics to assess facial growth. It provides good visualization of the nasopharyngeal soft tissues, paranasal sinuses, and hard palate.

A **reverse-Towne's projection** should be used to check for condylar neck fracture. It also demonstrates a medially placed condyle. The patient's forehead is placed on the film, tilted downward, and the mouth opened. This displaces the condyle from the TMJ and brings it down onto the articular eminence where it is better visualized.

Reference:

- White SC, Pharaoh MJ. *Oral radiology: principles and interpretation*, 4th Ed. Mosby, Inc. 2000. pp. 195-202.

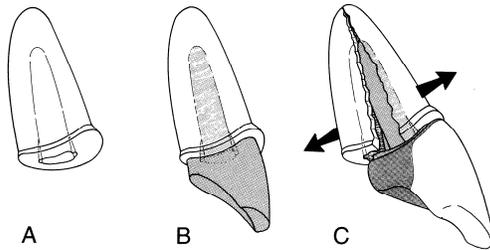
FIXED PROSTHODONTICS

Which of the following statements describes the ferrule effect?

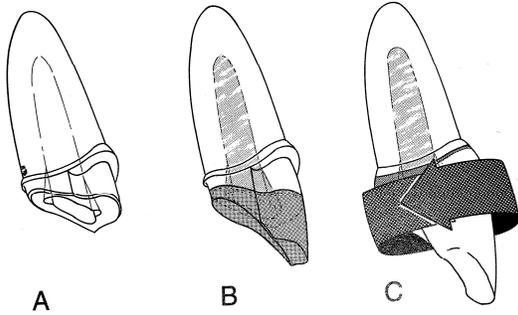
- Preparing for a full-coverage restoration by blending proximal axial reduction with buccal/lingual axial reduction.
- Maintaining a consistent cervical height for the finish line of a full-coverage preparation.
- Adding anti-rotational features to an endodontically treated tooth's cast post and core.
- Terminating the preparation of a completed crown on an endodontically treated tooth, 1.0-2.0 mm apical to the margin of core build-up material on natural tooth.

Answer: D

The ferrule effect is important when restoring endodontically treated teeth with fixed prosthodontic restorations. A band of natural tooth, known as a ferrule, is created when the endodontically treated tooth's completed crown preparation extends below the margin of the core buildup material – it is most preferable when the extension is 1.0 – 2.0 mm. The ferrule effect strengthens the weakened endodontically treated tooth and ensures that occlusal forces are redistributed to the natural tooth rather than its restored core. To create the ferrule effect in extensively damaged teeth, a periodontal crown-lengthening procedure often is necessary to access the natural tooth margin. Buccal/lingual reduction should be blended smoothly in the full-coverage preparation and consistent vertical finish line heights do enhance esthetics; neither is related to the ferrule effects.



If a tooth is flush with the gingival (A), fabrication of a post, core and crown without encirclement of the tooth structure by the crown walls could lead to root fracture (C).



A tooth without coronal tooth structure (A) can be protected by moving the crown preparation finish line apically to brace the tooth against root fracture.

Shillingburg HT et al. Fundamentals of fixed prosthodontics, ed. 3. Chicago: Quintessence Publishing Co.; 1997:191-196..

For occlusal equilibration the preferred grinding order for teeth is the nonsupporting cusps before the fossae. Most of these modifications take place on the maxillary arch.

- A. Both statements are true
- B. Both statements are false
- C. First statement is true, second is false
- D. First statement is false, first is true.

Answer: B

An occlusal adjustment is a dental procedure for the treatment of certain disturbances of the masticatory system. The preferential order for occlusal adjustment is:

- 1) fossae,
- 2) inclines,
- 3) nonsupporting cusps,
- 4) marginal ridges, and
- 5) supporting cusps

Before grinding anything, first analyze the contacts and mark the MI in red and the CRC in green – the “stuffed olive concept” grind the olive and leave the pimento.

Basic rules for grinding:

- 1). Narrow stamp cusps before reshaping fossae
- 2). Do not shorten a stamp cusp
- 3). Adjust centric interferences first
- 4). Eliminate all posterior incline contacts. Preserve cusp tips only.

The basic grinding rule to correct an anterior slide is always MUDL – Grind the Mesial inclines of the Upper teeth or the Distal inclines of the Lower teeth.

In an ideal occlusal arrangement, the load should be distributed evenly, preferably parallel to the long axes of the teeth. This is facilitated when the tips of the centric cusps are located centrally over the roots and when loading of the teeth occurs in the

fossae of the occlusal surfaces rather than on the marginal ridges. Horizontal forces are also minimized if posterior tooth contact during excursive movements is avoided.

Rosenstiel S, Land M, Fujimoto J. Contemporary Fixed Prosthodontics, 3rd ed. Mosby 2001:96.

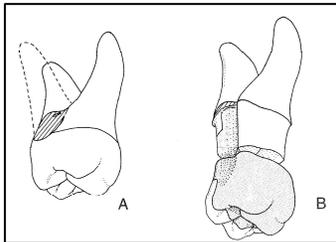
Dawson P. Functional Occlusion: From TMJ to Smile Design. Mosby 2007:393-403

When the DB root has been resected from a maxillary molar, the crown contours will be different because of the altered tooth shape. It is important that the contours of the distofacial cusp have a definite convexity apical to the contact area.

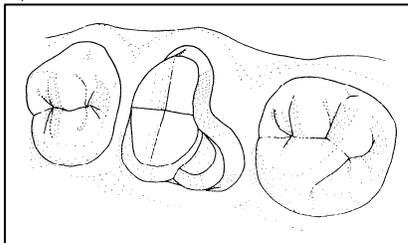
- A. Both statements are true
- B. Both statements are false
- C. First statement is true, second is false
- D. First statement is false, second is true.

Answer: C

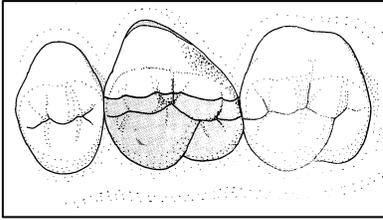
Maxillary Distofacial Root – this root is the most susceptible to frequent periodontal involvement because of its close proximity to the nearby second molar and inaccessibility by the patient. Once the distofacial has been removed, the occlusal outline resembles a lamb chop. The distofacial embrasure is larger than usual. The proximal contact should therefore be restored to its normal faciolingual size and the contour apical to the contact should be a definite concave shape.



Proper contours for a distofacial root resection on a maxillary molar after the area has been smoothed. The preparation does not cover all of the cut root surface.

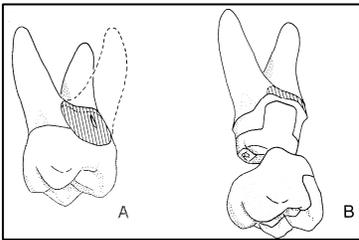


Occlusal view of a crown preparation, shaped like a "lamb chop"

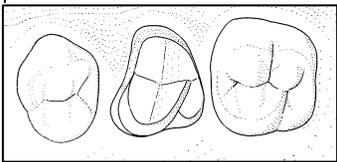


Occlusal view of a metal ceramic crown.

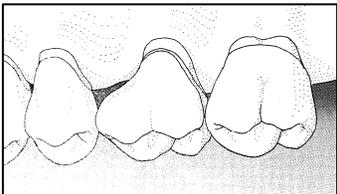
Maxillary Mesiofacial Root – loss of this root represents a greater loss of tooth support. The resulting occlusal outline tends to be more triangular in configuration. The finish line will extend apically past the pulp chamber, but not to include the entire area where the root was removed. There should be a concavity gingivofacial to the proximal contact on the mesial surface of the crown.



Mesiofacial root resection on a maxillary molar after the area surrounding the root attachment has been contoured. Crown is used to restore the tooth after a core is placed.

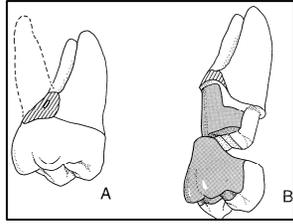


Occlusal view of the crown prep with a triangular shape.

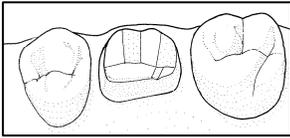


Facial view of the crown placed on a molar missing the MF root

Maxillary Palatal Root – when the palatal root has been removed, the surface of the preparation will be flat, reflecting the general configuration of the remaining root stump. The facial cusps of the prep will be near normal faciolingually and the lingual cusps will be quite small. There usually is a distinct concave flute on the facial surface arising from the facial bifurcation and no lingual cusps.

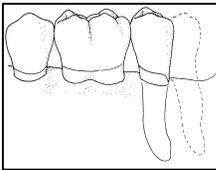


Area surrounding the root attachment of the palatal root after removal and smoothing.

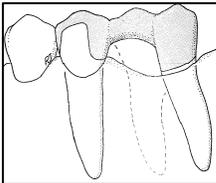


Occlusal view of maxillary tooth without the palatal root

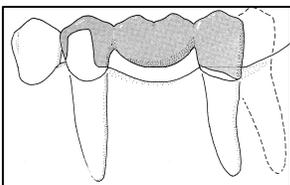
Mandibular Hemisection – Less possibilities with this configuration because there are only 2 roots. If the molar is the last tooth in the arch and the opposing teeth do not extend very far distal to the mandibular first molar, then it may be more desirable to save the mesial segment. Sometimes the distal root can be used as an abutment for a short-span FPD to replace the mesial root. If an attempt is made to save both segments, then the process is described as “bicuspidization”



Mesial root of the mand second molar can effectively extend the occluding segment of the mandibular arch to serve as a stop for the opposing occlusion.



Distal root of the mandibular molar can serve as an abutment for a short-span prosthesis replacing the resected mesial root.



Mesial root of a mandibular second molar can be the abutment for a molar replacement fixed partial denture, but it offers less than one-third of the support of an unresected molar.

Shillingburg 3rd Ed, 1997 214-221.

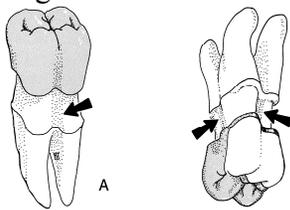
In cases where the crown margins of a molar must extend apically towards the furcation, which of the following is TRUE in the preparation of the finish line:

- 1). The convexities on the mesial and distal aspects of the maxillary molar should be blended into the surrounding axial surfaces of the crown.
- 2). The artificial crown should follow the original contours of the crown
- 3). Contours of the furcation flute should be recreated.
- 4). All the above are true

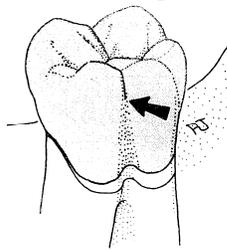
Answer: 3

The axial contours of crowns placed on teeth whose furcation flutes are intercepted by preparation finish lines must likewise reflect the concavity rising from the furcation flute. The artificial crown should recreate the contours of the furcation flute, NOT follow the original crown contours. The facial surface should be invaginated into a concavity above the bifurcation that extends occlusally until it meets the facial groove in the occlusal one-third of the facial surface. Concavities usually merge with features originating on the occlusal surface. There must be no interruptions in the vertical concavity rising at the margin of the restoration. Any horizontal ridge on the facial or lingual surface of the tooth that intersects with this concavity and blocks it will result in a plaque-retaining area (see last photo below).

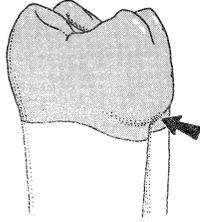
The concavities on the mesial and distal aspects of a maxillary molar arising from their respective furcations should be blended into the surrounding axial surfaces of the crown. This will help to minimize the difficulty of cleaning those areas in the less accessible lingual embrasures of the posterior segments of the maxillary arch.



Vertical concavities in the axial walls of the tooth preparations extend occlusally from the invaginations where the finish lines cross the furcation flutes on a mandibular and maxillary molar.



Anatomic facial groove of this mandibular first molar merges with the vertical concavity extending from the furcation flute.



horizontal ridge in the gingival third of the axial surface above the furcation flute will create a plaque-retaining area that is difficult to keep clean
Shillingburg 3rd Ed, 1997 214-221.

Screw-retained implant prostheses possess which of the following advantages: (select ONE answer)

- A. Ease of connection to natural teeth
- B. Ease of fabrication
- C. Ease of retrieval
- D. Esthetics
- E. Allows minor angle corrections between implant inclination and facial contour

Answer: C

One of the main advantages of the screw-retained prostheses is its ease of retrieval for maintenance and repair. A screw-retained prosthesis contains a small chimney where the screw fastens either directly to the implant or to the abutment. However, the access hole must be through the occlusal or lingual surface of the tooth, so esthetics may be compromised (**Answer D**). **Answer A** is incorrect because there is no relationship between connection to natural teeth and the type of implant prosthesis. **Answer B** is incorrect because abutments for screw retained are mostly machine-made. **Answer E** is incorrect because it is fastened directly to either the abutment or implant, leaving no room for minor angle corrections. Another disadvantage with the screw-retained is that the screw may loosen during function.

Rosenstiel S, Land M, Fujimoto J. Contemporary Fixed Prosthodontics, 4th ed. Mosby 2006:420.

Which of the following is a disadvantage for a cemented implant prosthesis?

- A. Ease of fabrication
- B. Allows minor angle corrections between implant inclination and facial contour
- C. Ease of retrieval
- D. Esthetics

Answer: C

Cemented prostheses are easier to fabricate because they are identical to traditional fixed partial dentures. Abutments can be prefabricated by the implant manufacturer and modified in the mouth or custom-made in the laboratory. Cementing allows minor angle

corrections to compensate for discrepancies between the implant inclination and the facial crown contour. Esthetics are an advantage because of the absence of screw-access occlusal holes. The main disadvantage of cement-retained prostheses is the difficulty of retrieval once it has been luted to the abutment.

Rosenstiel S, Land M, Fujimoto J. Contemporary Fixed Prosthodontics, 4th ed. Mosby 2006:420.

Dvorak Morning Questions – Fixed

Which of the following lists has the ceramics in proper order from best to worst marginal fit?

- a. Procera > Empress > In-Ceram**
- b. Empress > In-Ceram > Procera**
- c. In-Ceram > Procera > Empress**
- d. Empress > Procera > In-Ceram**

Answer: d

Studies have shown that of the three ceramics, Empress consistently has the smallest marginal gap, followed by Procera and finally In-Ceram. Actual size of marginal gaps appear to vary from restoration to restoration. One study had the following averages: IPS Empress (63 microns), Procera (83 microns) and In-Ceram (161 microns).

References:

Sulaiman F, Chai J, Jameson LM, Wozniak WT. A comparison of the marginal fit of In-Ceram, IPS Empress, and Procera crowns. *Int J Prosthodont.* 1997 Sep-Oct;10(5):478-84.

Yeo IS, Yang JH, Lee JB. In vitro marginal fit of three all-ceramic crown systems. *J Prosthet Dent.* 2003 Nov;90(5):459-64.

Fleming GJ, Dobinson MM, Landini G, Harris JJ. An in-vitro investigation of the accuracy of fit of Procera and Empress crowns. *Eur J Prosthodont Restor Dent.* 2005 Sep;13(3):109-14.

In the process of bonding a resin to a ceramic for a repair, the use of silane is recommended for improving chemical bonding with all ceramic systems. Bond strengths of resin composites to silica-containing ceramics after etching and

silanating are weaker than that of a resin-enamel bond after etching and using the same adhesive.

- a. Both statements are true.
- b. The first statement is true. The second statement is false.
- c. The first statement is false. The second statement is true.
- d. Both statements are false.

Answer: d

Bonding resin to conventional silica-based ceramics, whether it is porcelain or a glass ceramic is based on both micromechanical interlocking and chemical bonding. Porcelain and glass ceramics are usually etched with hydrofluoric acid and ammonium bifluoride to increase surface area and create microporosities. The adhesive resin flows into the porosities and interlocks creating micromechanical bonds. Additional surface roughening can be achieved with the use of a diamond or air abrasion. Chemical bonding is achieved by silanization with a bifunctional coupling agent. α -methacryloxypropyltrimethoxysilane (α -MPTS) is the most commonly used agent in dentistry. The silane group at one end chemically bonds to the hydrolyzed silicon dioxide at the ceramic surface and a methacrylate group at the other end copolymerizes with the adhesive resin. The silane must be hydrolyzed to be reactive. The bond strengths of resin composite to silica-containing ceramics after etching and silanating are in the range of resin-enamel bond strengths. A different approach is recommended for alumina (e.g. In-Ceram Alumina and Porcera AllCeram) and zirconium-oxide ceramics (Procera AllZirkon and LAVA). Since chemically reactive silicon dioxide (silica) is not present in alumina or zirconium-oxide ceramics, etching with hydrofluoric acid and silanization do not provide adequate bond strength. Surface roughening can be achieved with air abrasion for aluminum oxide and use of tribochemical surface treatment improves bond strengths to high crystalline ceramics. A silicate coating needs to be applied to the surface. Phosphate monomer-based adhesives (such as Panavia) are effective for bonding to these inert ceramics.

Ref: Fundamentals of Operative Dentistry. Third Ed. 2006. Pgs: 243-245.

All of the following methods can be used to increase retention of a crown, except:

- a. Decrease taper
- b. Addition of steps, shoulder/bevel or offsets
- c. Increase the height or length of the walls

d. Addition of grooves or boxes

e. None of the above

Answer: b

Retention is the prevention of removal of the restoration along the path of insertion or long axis of the tooth preparation.

Resistance is prevention of dislodgement of the restoration by forces directed in an apical or oblique direction and prevention of any movement of the restoration under occlusal forces.

Retention and resistance are often interrelated and inseparable qualities. Both retention and resistance are affected by the amount of taper of the restoration. Decreased taper improves both retention and resistance. An increase in height of the axial wall also increases both retention and resistance. The addition of grooves or boxes increases surface area and limits the path of withdrawal which increases both retention and resistance. The addition of steps, shoulder/bevel or offsets improves resistance, but has no effect on retention.

Ref: (Parker: JPros, Vol. 2, No. 1, 1993 Pgs: 61-6)

(Kishimoto: JPD;1983. 49:186-192)

(Fundamentals of Fixed Prosthodontics. Second Ed. 1981. Pgs:79-84)

Which of the following statements are true concerning the use of custom trays:

- a. Custom trays provide a more uniform thickness of impression material as compared with stock trays.**
- b. When used for hydrocolloid impression material, custom trays are more accurate.**
- c. Deviations in casts made with silicone impression material using either a custom tray or a stock tray are within a clinically acceptable range.**
- d. Custom trays are less accurate for open tray implant impressions than polycarbonate stock trays.**

i. a, b, d

ii. a, c

iii. b, d

iv. All of the above

Answer: ii

The main purpose of using custom trays is to achieve closer adaptation of the tray to the tissues which reduces the thickness of impression material in the tray and in theory reduces potential distortion in the poured up cast. Ref: (Fundamentals of Fixed Prosthodontics. Second Ed. 1981. pgs:228-9).

One study evaluated the accuracy of dimensional transfer of teeth position to the master cast. 80 impressions were taken including upper and lower impressions. Condensation silicone and hydrocolloid were used in both solid and perforated stock trays and acrylic custom trays. The resulting casts were measured and "the highest conformity with the original could be achieved with a hydrocolloid stock tray." The custom tray came up short compared to the original model for upper impressions and showed higher dimensional changes for the lower impressions. Ref: (Biffar R, Bittner B. Effects of different tray types on the resulting impression. Dtsch Zahnarztl Z. 1989 Aug;44(8):624-7).

Another study evaluated dimensional accuracy with respect to different types of trays, impression materials and pouring up at different times and multiple times. When used with silicone impression material neither stock trays nor custom trays contributed to differences in accuracy of the casts. All deviations were within a clinically acceptable range. Ref: (Thongthammachat S, Moore BK, Barco MT 2nd, Hovijitra S, Brown DT, Andres CJ. Dimensional accuracy of dental casts: influence of tray material, impression material, and time. J Prosthodont. 2002 Jun;11(2):98-108).

A study looked at the accuracy of implant fixture-level impressions and the affects of using stock versus custom trays. They found that custom trays were significantly more accurate than polycarbonate stock trays for the open tray impression technique. Ref: (Burns J, Palmer R, Howe L, Wilson R. Accuracy of open tray implant impressions: an in vitro comparison of stock versus custom trays. J Prosthet Dent. 2003 Mar;89(3):250-5).

Another study evaluated use of custom and stock trays with poly vinyl siloxane impression material. This study concluded that all casts distort but those made using custom trays are more accurate than those made with stock tray impressions. Ref: (Millstein P, Maya A, Segura C. Determining the accuracy of stock and custom tray impression/casts. J Oral Rehabil. 1998 Aug;25(8):645-8).

Which of the following statements concerning film thickness is/are false?

- a. According to the ANSI/ADA Specification No. 96, the film thickness of zinc phosphate cement is to be no greater than 25µm.**

- b. The film thickness of zinc phosphate cement decreases with an increased mixing temperature.**
- c. Film thickness for temporary cements should be no greater than 40µm.**
- d. Different brands of resin cements have to maintain their film thicknesses within a strict range.**
 - i. a, c**
 - ii. b only**
 - iii. b, d**
 - iv. All of the above are true**

Answer: iii

According to the ANSI/ADA Specification No. 96 the maximum film thickness for zinc phosphate cement is 25µm. The maximum film thickness for ZOE temporary cements should be no greater than 40µm.

The film thickness for zinc phosphate cements is affected by the following variables: Decreased powder/liquid ratio (decreases film thickness), increased rate of powder incorporation (increases film thickness), increased mixing temperature (increases film thickness) and water contamination (increases film thickness).

Ref: Restorative Dental Materials. 11th Ed. 2002. Pgs: 598-9, 603, 606-7.

One study measured the film thicknesses of five different resin cements and found a large range in film thicknesses with different products. The differences were statistically significant. The results were as follows: All-Bond 2 (58.8 +/- 4 microns), C&B-Metabond (35.8 +/- 1.2 microns), Enforce (22.9 +/- 1.4 microns), Imperva Dual (25.7 +/- 1.2 microns), and Panavia EX (44.3 +/- 1.2 microns). Ref: (van der Vyver PJ, de Wet FA. The film thickness of five adhesive resin cements. SADJ. 1998 Jul;53(7):377-9).

RESIN CEMENT FILM THICKNESSES ACCORDING TO DIS:

Panavia F	18 microns
Fuji Plus	10 microns
Vitremer luting cement	20 microns
Advance	20 microns
C & B Metabond	15-35 microns
Vivaglas Cem	25 microns
C & B Natural w/ fluoride	30 microns
Cement-it	< 21 microns

Chemlock	23 microns
Panavia 21	19 microns
Scotchbond Resin Cement	11.5 microns
Nexus	10-15 microns
DuoLink	25 microns
Choice	30 microns
Geristore	12 microns
Adherence	30 microns
Permalute	9 microns
Infinity Bond	2 microns
Opal Luting Cement	11 microns
Variolink II	22 microns
Enforce Sure Cure	21 microns

Fuji Duet Reinforced Multi-purpose Glass Ionomer Cement 32 ± 10.2 microns

Film Thickness Requirements according to textbook: Restorative Dental Materials, 11th Edition, Craig & Powers. 2002. Pg. 598-9

Water-Based Cements:

Glass ionomer (luting)	25 microns
Zinc Phosphate	25 microns
Zinc polycarboxylate	25 microns

Luting Cements:

Composite	13-20 microns
Glass ionomer	22-24 microns
Hybrid ionomer	10-22 microns
Zinc oxide-eugenol	
Polymer-modified	25 microns
EBA-alumina	25-35 microns
Zinc polyacrylate	25-48 microns
Zinc phosphate	25 microns maximum

Which of the following are true about impression materials?

- a) Tear strength of Polyether and Polysulfide is good*
- b) Polyether, Polyvinyl Siloxane, and Condensation Silicone can be poured for up to 7 days*
- c) The moisture tolerance of hydrophilic brands of PVS is adequate*
- d) Dimensional stability is a characteristic of addition silicone and polyether*
- e) The set material of PVS is very stiff*

- 1) a, c, d, e*
- 2) a, b, d*
- 3) c, d*
- 4) all of the above*

Answer: 3

Comparative Properties of Impression Materials

Type	tray	Ease of removal	Finish line readability	Moisture tolerance	Pouring time	Tear Strength	Pouring ease	Odor /taste	Radi-opaque	Shelf life mos	Setting time (min)
Reversible hydrocolloid	Stock	Easy	Poor	Excellent	15 m	Weak	Good	G	NO	24 – 48	5
Polysulfide	Custom	Mod.	Good	Acceptable	60 m	Good	Adequate	P	Yes	18	12-14
Condensation Silicon	Custom: 2 paste system Stock: Putty/ reline	Easy	Good	Poor	60 m	Adequate	Poor to Adequate	G	NO	12	10
Polyether	Custom: 4mm spacer Stock	Diff	Good	Good	7 days	Adequate	Good	P	NO	24	5-6
Polyvinyl Siloxane	Stock: single units Custom: Fixed Stock: putty reline	Mod to Diff	Good	Poor for standard Hydrophobic brands; Adequate for Hydrophilic brands	7 days	Adequate	Adequate	G	NO	24	6-8

Reference: Shillinburg. Fundamentals of Fixed Prosthodontics 3rd edition. 1997;p282

Reference: Rosentiel, Land, Fujimoto. Contemporary Fixed Prosthodontics. Elsevier. 2006;p 442.

Include irreversible hydrocolloid in the table

When deciding what kind of margin: porcelain vs. metal, the following things should be considered:

- a) *The porcelain margins are more esthetic*
- b) *Metal margins are more difficult to fabricate and therefore more expensive*
- c) *Easier plaque removal with porcelain margins*
- d) *Risk of fracture of unsupported porcelain margins during cementation.*

- 1) *a, c*
- 2) *a, b, c*
- 3) *a, c, d*
- 4) *all of the above*

Answer: 3

Porcelain margins	Metal Margins
<i>More esthetic</i>	<i>Less esthetic</i>
<i>Easier plaque removal</i>	
<i>Difficult fabrication</i>	
<i>Fx of unsupported margin during cementation or eval.</i>	
<i>More time consuming</i>	
<i>More expensive</i>	
<i>Inferior marginal adaptation</i>	<i>Better marginal adaptation</i>
<i>Contraindicated when an extremely smooth, Imm wide shoulder cannot be prepared in the area of the ceramic veneer</i>	

Check reference for validity

Reference: Rosentiel, Land, Fujimoto. Contemporary Fixed Prosthodontics. Elsevier. 2006;p 761-762.

Which of the following are true for porcelain Veneering alloys?

- a) *High noble metal is 45% noble*
- b) *Gold (Au), Palladium (Pd) and Platinum (Pt) are noble metals*
- c) *Pd-Ag is a base metal alloy*
- d) *Cobalt-Chromium (Co-Cr) is a noble metal alloy*
- e) *Noble metals alloys are 25% noble and have no gold requirement*

- 1) a, c, d
- 2) c, d, e
- 3) a, b
- 4) b, e

Answer: 4

Alloys for porcelain Veneering:

High Noble Metal:

60% Noble; (>40% gold)

Gold-Platinum-Palladium (Au-Pt-Pd)

Gold-Palladium-Palladium (Au-Pt-Pd)

Gold-Palladium (Au-Pd)

Noble Metal:

25% Noble; no gold requirement

Palladium-Silver (Pd-Ag)

Palladium-Copper-Gallium (Pd-Cu-Ga)

Palladium Gallium (Pd-Ga)

Predominantly Base Metal:

<25% Noble; no gold requirement

Nickel-Chromium (Ni-Cr)

Cobalt-Chromium (CO-Cr)

Reference: Rosentiel, Land, Fujimoto. Contemporary Fixed Prosthodontics. Elsevier. 2006; p 602-606.

Although every effort is made to fabricate metal-ceramic fixed partial dentures as a single unit, it is sometimes necessary to solder the units together. This is true in all of the following cases except:

- A. There is distortion in a single-piece fixed partial denture casting
- B. One retainer has inadequate margins and must be redone
- C. The fixed partial denture length is too great for an accurate single-piece casting
- D. The fixed partial denture solder joint is too thin to prevent fracture
- E. Type III partial veneer retainers are used in an otherwise metal-ceramic fixed partial denture

Answer is: **D**

Although the solder joint must be an adequate thickness to prevent fracture it has no bearing in the reasons as to why you might solder as a single unit.

Reference:

Shillingburg HT, et al. Fundamentals of Fixed Prosthodontics. 3rd edition. Quintessence books. 1997 pp. 520-521

All of the statements concerning Ante's Law are correct except?

- A. Roots that are broader mesiodistally than labiolingually are preferable to roots that are round in cross section.
- B. Multi-rooted posterior teeth with widely separated roots are preferable to conical shaped roots.
- C. Crown to root ratio, root configuration and PDL area are all taken into consideration using Ante's Law
- D. In longer span FPD's failures from abnormal stress have been attributed to leverage and overload rather than torque.
- E. The roots of maxillary posterior teeth generally have more surface area than mandibular Posterior teeth.

- 1. A & B
- 2. B & C
- 3. C & E
- 4. A & D
- 5. B & E

Answer is: **4 A & D**

Roots that are broader **labiolingually than they are mesiodistally** are preferable to roots that are round in cross section.

In longer span FPD's, failures from abnormal stress have been **attributed to leverage and torque rather than overload.**

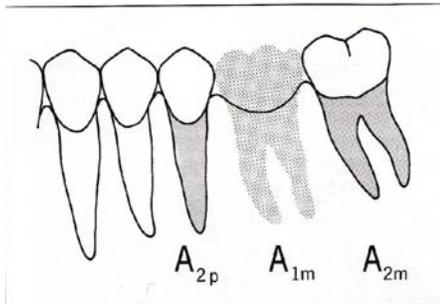


Fig 7-10 The combined root surface area of the second premolar and the second molar ($A_{2p}+A_{2m}$) is greater than that of the first molar being replaced (A_{1m}).

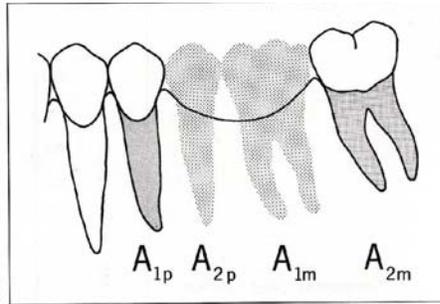


Fig 7-11 The combined root surface area of the first premolar and the second molar abutments ($A_{1p}+A_{2m}$) is approximately equal to that of the teeth being replaced ($A_{2p}+A_{1m}$).

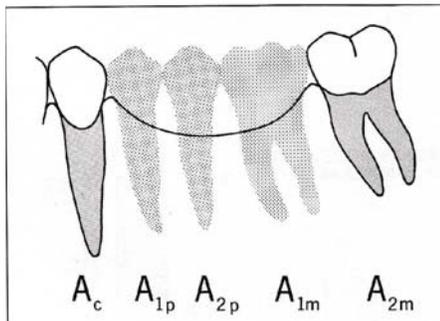
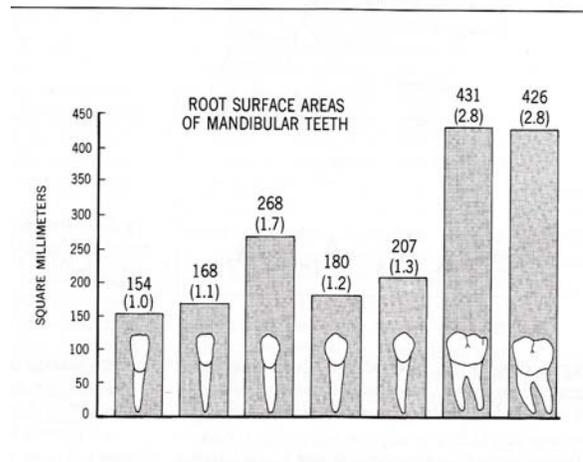
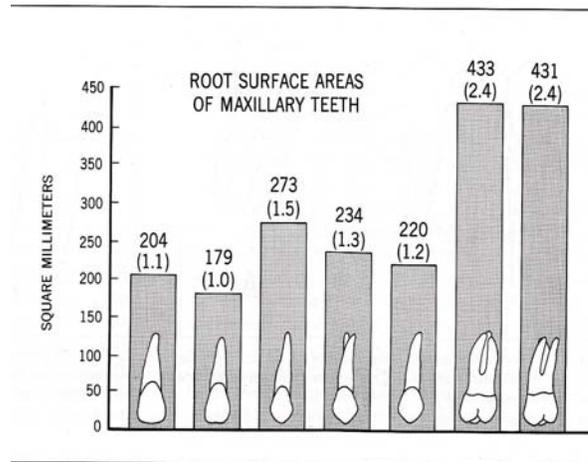


Fig 7-12 The combined root surface area of the canine and second molar (A_c+A_{2m}) is exceeded by that of the teeth being replaced ($A_{1p}+A_{2p}+A_{1m}$). A fixed partial denture would be a poor risk in this situation.



Reference:

Shillingburg HT, et al. Fundamentals of Fixed Prosthodontics. 3rd edition. Quintessence books. 1997 pp89-92.

All of the following concerning the Law of Beams are true except:

- a. Bending or deflection varies directly with the cube of the length and inversely with the cube of the occlusolingival thickness of the pontic
- b. A pontic with a given occlusolingival dimension will bend four times as much if the pontic thickness is halved
- c. A three tooth pontic will bend 27 times as much as a single tooth pontic
- d. A long span fixed partial denture on short mandibular teeth could have disappointing results

e. Double abutments are sometimes used as a means of overcoming problems created by unfavorable crown to root ratios and long spans

Answer is: **B**

A pontic with a given occlusogingival dimension will bend eight times as much if the pontic thickness is Halved, because it is the inverse cube of the pontic thickness.....thereby dividing in half (by 2) would Be $(2^3)=8$.

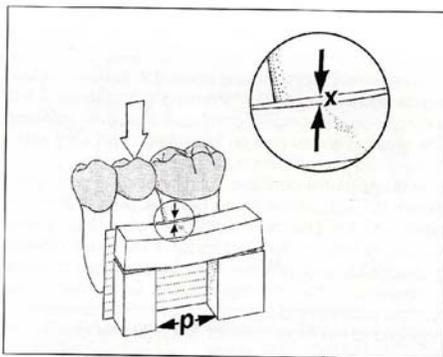


Fig 7-13 There is one unit of deflection (X) for a given span length (p).

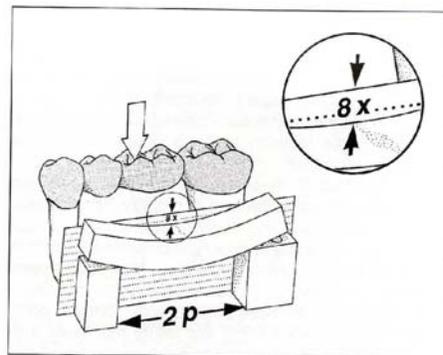


Fig 7-14 The deflection will be 8 times as great (8X) if the span length is doubled (2p).

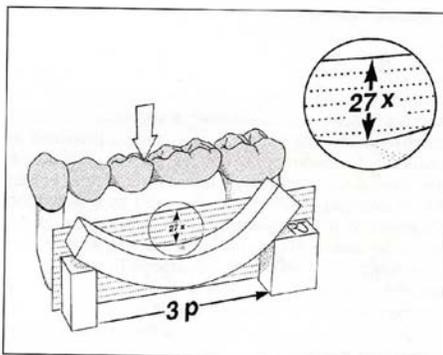


Fig 7-15 The deflection is 27 times as great (27X) when the span length is tripled (3p).

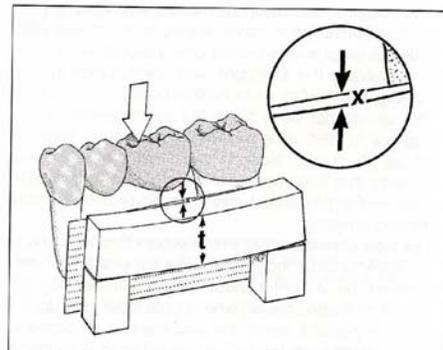


Fig 7-16 There is one unit of deflection (X) for a span with a given thickness (t).

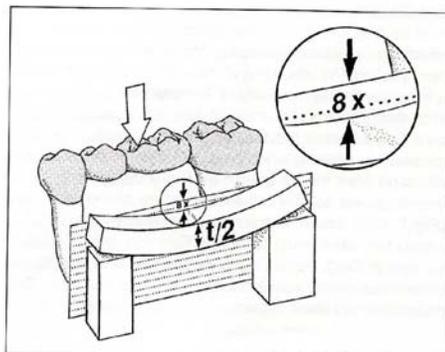


Fig 7-17 There will be 8 times as much deflection (8X) if the thickness is decreased by one-half ($t/2$).

Reference:

Shillingburg HT, et al. Fundamentals of Fixed Prosthodontics. 3rd edition. Quintessence books. 1997 pp 93.

If a nonrigid connector is placed on the distal side of the retainer on a middle abutment, movement in a mesial direction will seat the key into the keyway. If a nonrigid connector is placed on the mesial side of the middle abutment mesially directed movement will unseat the key.

- a. Both statements are true
- b. Both statements are false
- c. First statement is true and the second one is false
- d. First statement is false and the second one is true

Answer is: **A**

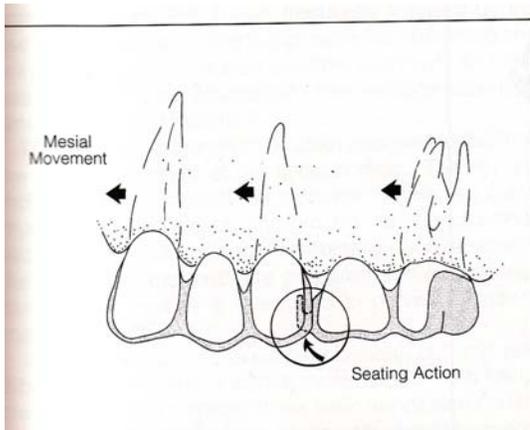


Fig 7-24 If a nonrigid connector is placed on the distal side of the retainer on a middle abutment, movement in a mesial direction will seat the key into the keyway. (From Shillingburg and Fisher.¹⁹)

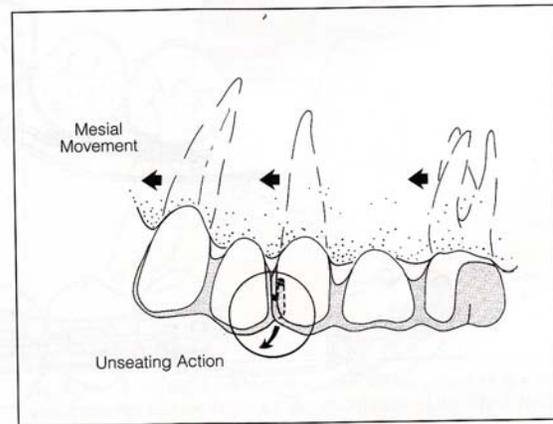


Fig 7-25 If a nonrigid connector is placed on the mesial side of the middle abutment, mesially directed movement will unseat the key. (From Shillingburg and Fisher.¹⁹)

Reference:

Shillingburg HT, et al. Fundamentals of Fixed Prosthodontics. 3rd edition. Quintessence books. 1997 pp 95-97.

Which type of bone is most preferable when placing a dental implant?

- a. Type I bone
- b. Type II bone
- c. Type III bone
- d. Type IV bone

Answer is: **B**

Type I bone is comparable to oak wood, which is **very hard and dense**. This type of bone has **less blood supply than all of the rest of the types of bone**. The blood is required for the bone to harden or calcify the bone next to the implant. Therefore, it takes approximately **5 months for this type to integrate** with an implant as opposed to 4 months for type II bone.

Type II bone is comparable to pine wood, which isn't as hard as type I. This type of bone **usually takes 4 months to integrate with an implant**. It is the preferable bone for dental implants.

All of the following metals except for which 3 are included in the platinum group according to the ADA council on Scientific Affairs revised classification system (2003)?

- a. Platinum
- b. Palladium
- c. Titanium
- d. Copper
- e. Rhodium
- f. Iridium
- g. Osmium
- h. Ruthenium
- i. Polonium 210

Ans.:

d,g and i

c,d and i

c,d and g

d,h and i

d,e and i

Answer: c,d and i: The revised classification for alloys for fixed prosthodontics is as follows:

CLASSIFICATION	REQUIREMENT
High Noble Alloys	Noble Metal Content $\geq 60\%$ (gold +

	platinum group) and gold \geq 40%
Titanium and Titanium Alloys	Titanium \geq 85%
Noble Alloys	Noble Metal Content \geq 25% (gold + platinum group)
Predominantly Base Alloys	Noble Metal Content $<$ 25% (gold + platinum group)

The platinum group metals are:

- Platinum
- Palladium
- Rhodium
- Iridium
- Osmium
- Ruthenium

The platinum group metals harden and strengthen gold alloys. Platinum is the best hardener and strengthener and increases the tarnish and corrosion resistance of the alloy (as does gold). Platinum increases the melting temperature radically, so its use in casting gold alloys is limited to 3-4%. Palladium affects the alloy in much the same way as platinum. It significantly increases the tarnish resistance for a given gold content, and is less expensive than platinum. However, it does not strengthen and harden the alloy as effectively as platinum. Iridium in small amounts (0.005%) can reduce the grain size of the alloy, with improvement in ductility.

Copper is a non-noble metal that does add strength and hardness but also adds a redder color.

Polonium 210 is radioactive. Marie Curie named it after her Motherland (Poland). It is not used in dental alloys.

Titanium Alloys consist of the new classification. They are especially suitable for dental implants and prostheses. For crown and bridge prostheses, they can be used, but are not often used so because of the higher cost of casting them. Titanium must be cast in a vacuum or inert gas environment to prevent rapid oxidation of the metal, which creates brittleness. It is rated between High noble and Noble alloys.

American Dental Association, Copyright 1995-2007, JADA, Vol. 134, March 2003 (p. 346)

Elements of Dental Materials, 4th ed., Copyright 1984 W.B. Saunders Co., p. 247-248

T or F: The ovate or bullet-shaped tip creates the most esthetic possible pontic while also creating the most cleansable type of pontic known.

Answer: F. The ovate pontic can be used to develop a close relationship to the residual ridge. “While being contoured, the tip is occasionally evaluated by trying the pontic in the space” while in interim prosthesis. Passive contact maximizes phonetic and esthetic potential. “However, in the mandibular arch, where esthetics is not generally a problem, the pontic tip is best shaped into the same bullet-shaped design but positioned as a hygienic pontic type that does not contact tissue.”

Another pontic style is the modified ridge lap which involves a facial segment that contacts the tissue to the facial of a posterior tooth and under the incisal edge of an anterior tooth. These are modified from a ridge lap design that covers the ridge but creates inflammation by creating a hard to cleanse area. The chief cause of ridge irritation is the toxins released from microbial plaque. This tends to accumulate between the gingival surface of the pontic and the residual ridge unless the patient is meticulous with oral hygiene. The sanitary pontic creates an easily cleansable area while the ovate pontic with ridge augmentation creates a recessed form that is not susceptible to food impaction. The broad convex geometry also creates a stronger pontic than the modified ridge lap design because the unsupported thin porcelain at the gingivofacial extent of the pontic is eliminated.

Roberson, Sturdevant’s Art and Science of Operative Dentistry, 4th ed., 2002, p. 637.
Rosenstiel et al., Contemporary Fixed Prosthodontics, 3rd ed., 2001 p. 525

CAD/CAM systems use digital information about the tooth preparation or a pattern of the restoration to provide a computer-aided design on the video monitor for inspection and modification. Once the image is accepted, the computer mills a wax or plastic replica of the desired form for casting.

- a. Both statements are true
- b. The first statement is true, the second false
- c. The first statement is false, the second true
- d. Both statements are false

Answer:

- b. CAD/CAM uses digital information to create a computer-aided design (CAD) that the computer translates into a set of instructions to guide a milling tool (computer-assisted manufacturing- CAM) in cutting the restoration from a block of material. The first commercially available such machine was the CEREC systems machine, but others have become available. Restorations can be machined from metals, ceramics or composites, but ceramics are generally preferred. Bonding of ceramic CAD/CAM restorations is critical, and generally involves use of hydrofluoric acid and silanating agents, followed by use of a composite cement.

Most CAD/CAM restorations are uniform in color because they are milled from a solid block of material and depend on light scatter from adjacent tooth structure for best esthetics.

Roberson, Sturdevant's Art and Science of Operative Dentistry, 4th ed., 2002, p. 220-222

The following are contraindications for use of epinephrine as a hemostatic agent in retraction cords:

- a. Patients with cardiovascular disease
- b. Patients with diabetes
- c. Patients taking Rauwolfia compounds, ganglionic blockers or monoamine oxidase inhibitors
- d. Patients with a known sensitivity to epinephrine
- e. All of the above

Answer: e. All are contraindications to epinephrine use as a hemostatic agent. The amount of systemic exposure varies depending on the exposure of the vascular bed, the time of contact and the amount of epinephrine used. Typically, from a 2.5cm cord over 5-15 minutes, the amount of epinephrine absorbed is 71 micrograms, slightly less than that obtained from an injection of four carpules of local anesthetic with epinephrine at a 1:100,000 concentration. This is 1/3 the maximum dose of 0.2mg for a healthy adult and twice the recommended maximum dose for a cardiac patient.

Shillingburg et al, Fundamentals of Fixed Prosthodontics, 3rd ed., 1997p. 261

Non-epinephrine hemostatic agents that can be used in retraction cords include which ones of the following?

- a. Aluminum chloride (Gingi-Aid, Viscostat Clear, Hemodent)
- b. Aluminum potassium sulfate (Gingibraid)
- c. Aluminum sulfate (Rastringent 2)
- d. Ferric sulfate (Astringent, Viscostat)
- e. Oxymetazoline hydrochloride 0.05% (Afrin)
- f. Tetrahydrozoline hydrochloride 0.05% (Visine)

Answer: All of the above, in appropriate doses. Dilute aluminum chloride created no additional inflammation, but in more concentrated (60%) solutions, necrosis and severe inflammation was found in dog studies. A study on human subjects found no significant difference in hemostasis and tissue inflammation between epinephrine verses aluminum sulfate, aluminum potassium sulfate and aluminum chloride treated cords.

Oxymetazoline hydrochloride 0.05% (Afrin) and tetrahydrozoline hydrochloride 0.05% (Visine) were found to be 57% MORE effective at widening the gingival sulcus and controlling hemorrhage than epinephrine.

Shillingburg et al, Fundamentals of Fixed Prosthodontics, 3rd ed., 1997, p.262

Which of the following is/true regarding survival or success rate of a conventional FPD vs. an implant?

- a) caries is the most common cause of FPD failure
- b) single tooth implants have 70% success rate for 10 years
- c) 50% survival at 10 years for FPD
- d) Single tooth implants better than 97% success rate at 10 years
- e) Failure of abutment teeth in FPD is 50% at 10 years
- f) 15% of FPD abutments require endo tx

- 1) a,d
- 2) a,c,d,f
- 3) b,e
- 4) d,e

Answer: 2

Single tooth replacement: Fixed Partial Denture

Estimated mean life span of fixed partial denture (50% survival) is reported to be 10 years.

Caries most common cause of fixed partial denture failure.

15% of fixed partial denture abutments require endodontic tx.

Failure of abutment teeth of fixed partial denture is 8% to 12% at 10 years and 30% at 15 years.

80% of teeth adjacent to missing teeth have minimal or no restoration.

Single tooth implants:

High success rates (better than 97% for 10 years).

Decreased risk of caries of adjacent teeth.

Decreased risk of endodontic problems on adjacent teeth

Improved hygiene.

Decreased cold or contact sensitivity of adjacent teeth.

Psychological advantage/

Decrease abutment tooth loss.

Reference: Misch C. Dental Implant Prosthetics. 2005. Mosby. P3-4

Which of the following are true about implants?

- a) *Maxillary fixed implant supported prostheses are fabricated on an average of 4 standard implants*
- b) *Implants should not be closer than 4mm*
- c) *In an edentulous maxilla 7-10 implants are recommended*
- d) *To compensate for poor bone more implants can be planned*

- 1) *c,d*
- 2) *b,c*
- 3) *a,b,c*
- 4) *all of the above*

answer: 1

*Two implant bodies should be more than **3mm** apart. Tarnow et al have observed that the horizontal dimension of a crestal defect next to an implant measures almost 1.5mm. If the implants are closer than **1.5mm**, a vertical angular defect may result in horizontal bone loss between the implants.*

***Full maxillary fixed implant-supported prostheses** are fabricated on an average of **6** standard diameter implants with posterior and anterior cantilevers.*

To compensate for poor bone more implants can be planned.

*In an **edentulous maxilla 7-10** implants should be used: at least 1 central incisor, bilateral canine, bilat 2nd Pms and bilat distal half of the max 1st molar sites.*

These 7 implants should be splinted together to function as an arch.

Misch C. Dental Implant Prosthetics. 2005. Mosby. P285-291

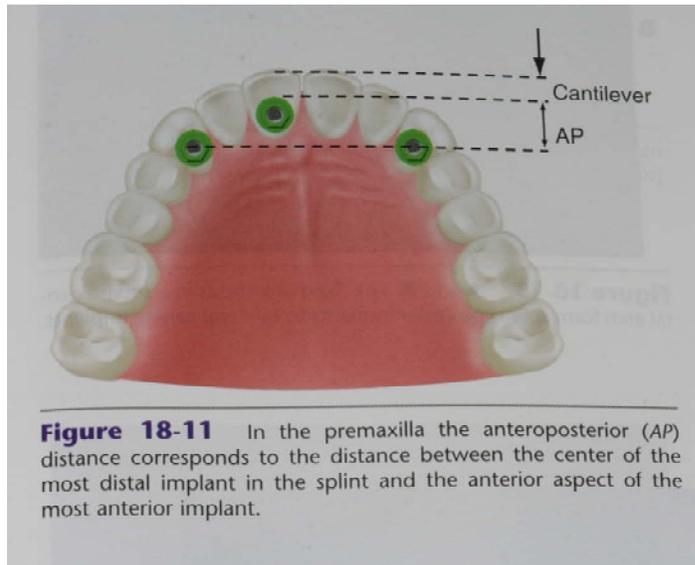


Figure 18-11 In the premaxilla the anteroposterior (AP) distance corresponds to the distance between the center of the most distal implant in the splint and the anterior aspect of the most anterior implant.

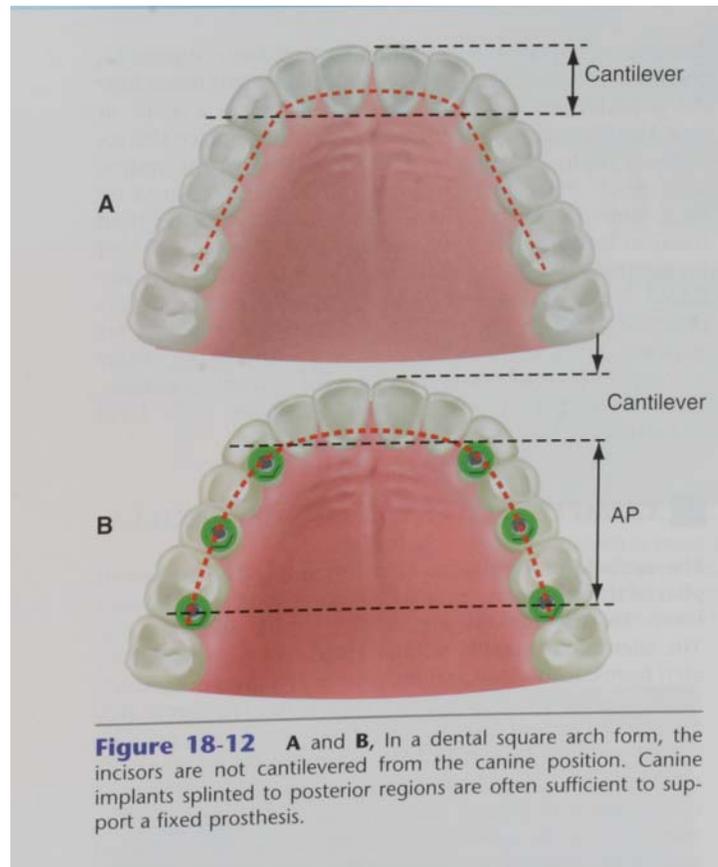


Figure 18-12 **A** and **B**, In a dental square arch form, the incisors are not cantilevered from the canine position. Canine implants splinted to posterior regions are often sufficient to support a fixed prosthesis.

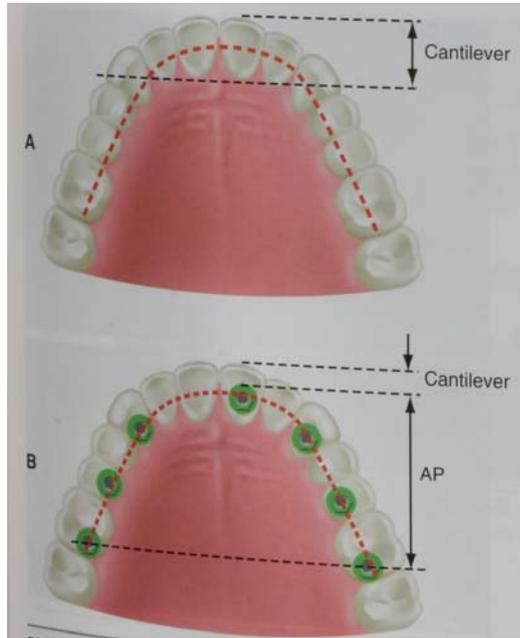


Figure 18-15 A and B, The ovoid dental arch form often requires three anterior implants (bilateral canine, and incisor) splinted to posterior implants for a fixed prosthesis.

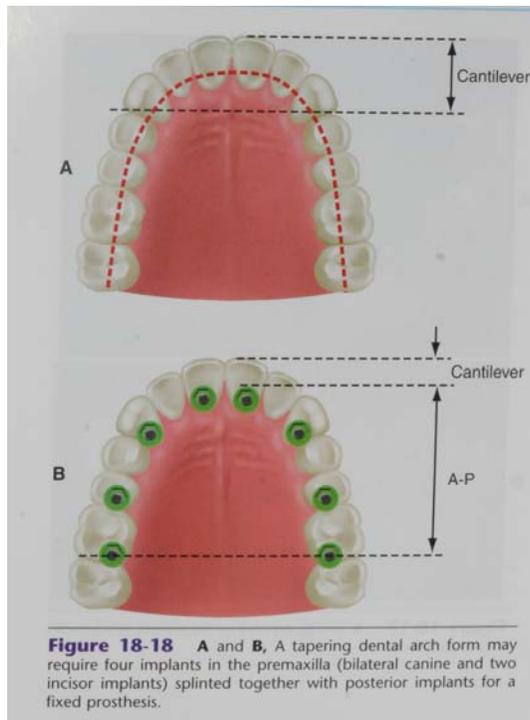


Figure 18-18 A and B, A tapering dental arch form may require four implants in the premaxilla (bilateral canine and two incisor implants) splinted together with posterior implants for a fixed prosthesis.

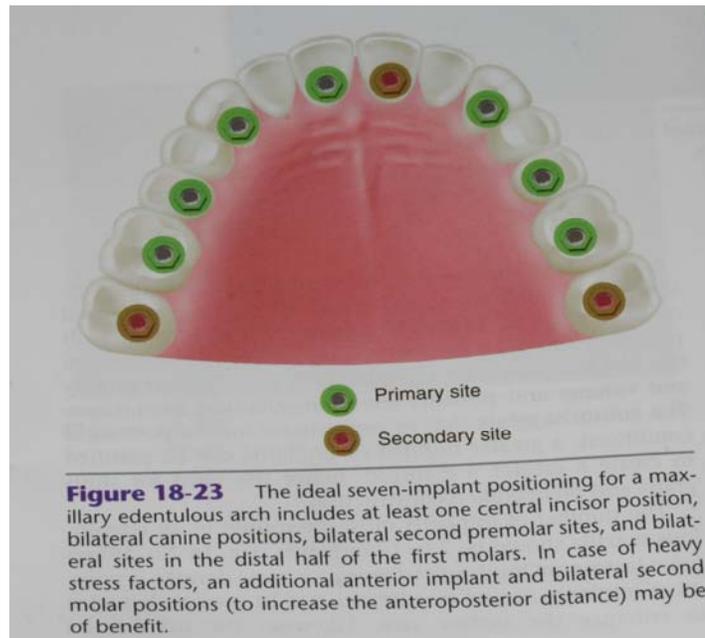


Figure 18-23 The ideal seven-implant positioning for a maxillary edentulous arch includes at least one central incisor position, bilateral canine positions, bilateral second premolar sites, and bilateral sites in the distal half of the first molars. In case of heavy stress factors, an additional anterior implant and bilateral second molar positions (to increase the anteroposterior distance) may be of benefit.

Which of the following implant types does NOT have a processed surface?

- a. Titanium plasma sprayed (TPS).
- b. Hydroxyapatite coated (HA).
- c. Commercially pure titanium.
- d. Sandblasted.
- e. Acid-etched.

Answer: c. Commercially pure titanium.

While smooth surface implants are successful in types I-III bone, failure rates are higher in type IV bone. Surface processing was introduced to try to improve success in these sites in the early 1980's.

Processing may be additive, ie: treating the surface with a TPS (titanium plasma spray) or coating it with HA (hydroxyapatite), or subtractive, when the surface is sandblasted or etched (usually in hydrochloric-sulfuric acids or hydrofluoric-nitric acids). A drawback to the additive technique is loss of the coating from the implant surface, leading to entrapment and inflammation in the adjacent tissue. All surface treatments increase the risk of bacterial retention next to the implant and subsequent peri-implantitis. Generally speaking, the preferred technique is acid etching because it introduces no contamination of any kind onto the implant surface.

The hybrid surface (Osseotite by 3i) leaves the coronal 3mm of the implant smooth, decreasing the risk of bacterial colonization and improving soft tissue health . Both are advantageous.

Reference: Davarpanah M, Martínez H, Kebir, M, Tecucinau JF. *Clinical manual of implant dentistry*. Quintessence. 2003.

In type IV bone, standard diameter implants with lengths less than ____ have been noted to have failure rates as high as 28-35%.

- a. 9.0mm
- b. 10.0mm
- c. 11.5mm
- d. 13.0 mm

Answer: b. 10.0mm

Standard diameter implants are 3.75-4.00mm in diameter. Small diameter implants are 3.4mm or less in diameter, and large diameter implants are 4.5mm or more in diameter. Historically, 10.0mm was considered the minimum length for implant success because only standard diameter platforms were available.

Today, implants of differing diameters are available to help meet the esthetic and restorative demands of patients. Indications for narrow-bodied implants include cases where interradicular space is reduced, the alveolar ridge is thin, or a limited cervical diameter is needed for the prosthesis (ie: lower incisors). Wide-bodied implants are indicated when bone quality is poor or ridge height is less than ideal because the increased diameter allows more area for osseointegration. They are also indicated for immediate replacement of non-osseointegrated implants, immediate replacement of fractured implants and immediate implant placement following extraction. Finally, they are indicated for the replacement of single molars.

Selection of implant length and width should also be based on the following: 1. Residual bone volume: 2mm of bone should be present between the fixture and the inferior alveolar nerve; it is not necessary to leave bone between the implant and the maxillary sinus. The ridge crest should be 2mm wider than the planned fixture buccolingually to allow for 1mm of bone on each side of the fixture. Likewise, mesiodistal space should equal at least the implant diameter plus 2mm. If there is insufficient space for the 10.0mm standard implant, a wider diameter fixture should be selected because the larger surface area will allow for better osseointegration. 2. Bone quality: In poorer quality bone, more implant surface area should be placed, by increasing either the length and/or width of the implant fixture. 3. Implant size can be roughly based on the shape of the root that the implant will replace. 4. Emergence profile/ Biomechanical behavior: Obviously, molars will need a wider-diameter implant and mandibular incisors a smaller one. This will also help to avoid cantilevers by placing a large prosthesis on a small fixture.

If you are going to replace multiple adjacent teeth with implants, use the following formula to determine the number of fixtures needed:

$$\# \text{ of implants} = (\text{mesiodistal width} - 1 \text{ mm}) / (\text{implant diameter} + 3 \text{ mm})$$

Roughly speaking, for 3.75-4.0mm standard platform implants, one fixture can be placed into each 7.0-7.5mm of edentulous space.

Reference: Davarpanah M, Martínez H, Kebir, M, Tecucinau JF. *Clinical manual of implant dentistry*. Quintessence. 2003.

Which of the following is NOT a contraindication to implant placement?

- a. Major psychologic disorders.
- b. Uncontrolled systemic diseases.
- c. Alcohol or medication-dependent patients.
- d. Post-adolescent patients.
- e. Insufficient interocclusal space.

Answer: d. Post-adolescent patients.

Contraindications to implants may be either absolute or relative.

Absolute contraindications include answer choices a-c, in addition to those patients at risk for heart pathologies.

Relative contraindications include answer choice e, cases with insufficient volume or poor quality of bone, and patients with an increased risk of failure (due to prior irradiation, bruxism, uncontrolled periodontitis, or tobacco smoking).

Reference: Davarpanah M, Martínez H, Kebir, M, Tecucinau JF. *Clinical manual of implant dentistry*. Quintessence. 2003.

When planning a prosthesis supported by multiple implants, it is important to consider the distribution of implants and the concept of cantilevers. For a fixed-

hybrid prosthesis, implant fixtures may experience localized forces 2-3 times the biting force when cantilevers are present.

- a. Both statements are true.
- b. The first statement is true and the second is false.
- c. The first statement is false and the second is true.
- d. Both statements are false.

Answer: a. Both statements are true.

In a case where a fixed-hybrid prosthesis is placed with 6 implants in the anterior area of the maxilla or 4-5 implants between the mental foramina, the posterior areas will be cantilevered. The distal-most abutments will serve as fulcra, and the anterior abutments will oppose biting forces in the posterior areas. These anterior abutments will be subject to tensile forces, while the fulcruming implants will be placed under compressive forces. The longer the cantilever arm, the greater the forces placed on the abutments. Without careful treatment planning, forces in excess of those required to remove osseointegrated implants from bone may be generated. It is not uncommon for the tensile forces to be twice the biting force and for compressive forces to approach three times the biting force due to the geometric configuration of the implants, prosthesis, and lever arm.

When restoring an edentulous arch with an implant-supported prosthesis, one should try to achieve the greatest possible anterior-posterior span with implants to minimize cantilevers.

Reference: Worthington P, Lang BR, Rubenstein JE. *Osseointegration in dentistry: an overview*. 2nd Ed. Quintessence. 2003.

Horizontal forces on an implant-supported crown can cause all of the following EXCEPT:

- a. Loosening of the abutment screw.
- b. Mobility of the implant fixture.
- c. Fracture of the implant fixture.
- d. Wear on opposing teeth.
- e. All can be caused by horizontal forces.

Answer: e. All can be caused by horizontal forces.

The clinician should attempt prosthetic loading of implants in the long axis of the fixture whenever possible. As implants do not have the physiologic mobility afforded to teeth by the periodontal ligament, oblique forces on components can subject the fixture to large forces. These can result in damage to the fixture, development of mobility, fracture of the fixture or restorative components, and ultimately failure of the implant-supported restoration.

Unfortunately, it is not always possible to load every implant along the long axis. Techniques such as using a larger diameter fixture or splinting fixtures together with bars or fixed partial denture-type restorations can help distribute forces and minimize the impact of off-axis loading. Angled abutments may be used, but should be used in carefully selected cases because of the levers they create.

Reference: Davarpanah M, Martínez H, Kebir, M, Tecucinau JF. *Clinical manual of implant dentistry*. Quintessence. 2003.

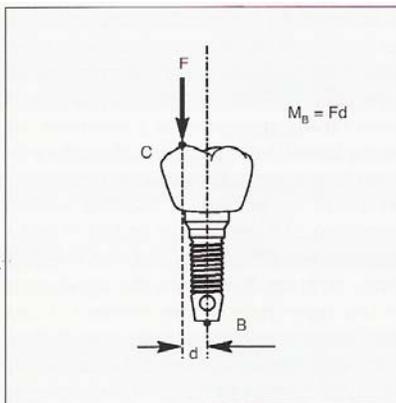
An off-axis force of 400N is applied vertically 2mm from the center of an implant-supported crown replacing tooth #30. What is the torque applied that the implant fixture must withstand? Is the resultant force on the fixture greater in the cervical or apical area?

- a. Torque = 800 Nmm, force greater in the cervical area.
- b. Torque = 800 Nmm, force greater in the apical area.
- c. Torque = 200 N/mm, force greater in the cervical area.
- d. Torque = 200 N/mm, force greater in the apical area.

You change it

b. Torque = 800 Nmm or 80 Ncm, force is greater in the apical area.

See figure below. A Moment (M_b) or torque is a vector quantity equal to the product of a force (F) and a the distance (d) along a line perpendicular from the central axis (of the implant in this case) to the point of force application. Since the center of mass of the crown/abutment/implant complex is in the cervical area, the resultant force on the fixture will be greater the farther you are from this point → more apically.



Adapted from Reference below.

REMOVABLE PROSTHODONTICS

Match the impression philosophy with its correct description (use as many times as needed):

- A. Mucostatic Impression
- B. Selected Pressure Impression
- C. Functional Impression

1. Developed by the patient's own functional movements and anatomy
2. Captures intimate tissue detail of very healthy, unloaded keratinized tissues.
3. Captures primary denture bearing areas in a pre-loaded and pressurized state.
4. Final cast is a static representation of the dynamic forces placed on the tray and impression material
5. Tray contains free-flowing, quick setting, and rigid setting impression material
6. Soft tissues are captured anatomically with minimal overextension.

Answer:

1-C

2-A

3-B

4-C

5-A

6-B

There are three basic impression philosophies are recommended for complete-denture construction: a). the mucostatic (low pressure) technique, b) the functional technique and c) the selected-pressure technique.

Mucostatic Pressure technique attempts to record the oral tissues “at rest”. It requires that minimal pressure be applied to the oral tissues during the seating of the impression tray and set of the impression material, and requires a material of high fluidity (lo viscosity). This technique seeks to eliminate all distortion of the oral tissues and thus create a denture base that models the unloaded tissues.

Functional-impression technique uses a complete denture that is delivered, relieved on its internal aspects, and filled with a slow-setting impression material (tissue conditioning material). The patient wears the prosthesis for several days, allowing the tissues to be recorded “in function”. The completed impression then is converted to a hard relined material via laboratory processing. This technique seeks to create a denture base that models the functionally loaded tissues.

The selected-pressure technique uses custom trays constructed with less relief in the primary denture stress-bearing areas, and greater relief (and therefore, more impression material) in the nonbearing areas. Variations in the amount of relief result theoretically in greater amounts of pressure being applied directly to the primary bearing areas, which are biologically and biomechanically more capable of supporting and distributing the loads. Less pressure is applied through greater relief for impression materials to the nonbearing areas. This technique seeks to create a denture base that selectively loads the oral tissues during function of the prostheses, thus optimizing the stability and retention of the prostheses.

Felton DA, Cooper LE, Scurria MS. Predictable impression procedures for complete dentures. Dent Clin N Amer Jan 1996; 40(1): 39-51.

An advantage to using polyether impression material for border molding complete denture impressions instead of compound modeling plastic is that:

- 1). Border molding may be accomplished in one step with polyether.
- 2). Polyether is easier to disinfect
- 3). Polyether causes less tissue irritation
- 4). Taste and patient acceptance are much better with polyether.

Answer: 1

The polyether impression material is most suitable for border molding the entire border of the custom tray. Among other reasons are: 1) good setting time; 2) sufficient body to remain in position prior to insertion; and 3) does not cause significant displacement of the tissues of the vestibule. Disinfection is similar to other impression techniques and taste/odor has not been patient acceptance factors.

	Alginate	Condensation Silicones	Polysulfides	Polyethers	Addition Silicones
Examples	Irrev hydrocolloid	Elasticon, Citricon, Xanotopren	Permalastic, Omniflex	Impregum, Permadyne	Blue mousse, Express, repositol
Advantages	<ul style="list-style-type: none"> - inexpensive - easy to use - hydrophilic - rapid set, adjusted by water temp - neutral taste - good tissue adaptation 	<ul style="list-style-type: none"> - putty/wash eliminates need for custom tray - neutral taste and odor - economical 	<ul style="list-style-type: none"> - economical - long working time 4-6 minutes - hi tear strength - good detail reproduction - combo of good flow and hi tear strength = choice for indirect cast post and cores 	<ul style="list-style-type: none"> - hydrophilic - high tear strength - hi dimensional stability - short working and setting times 	<ul style="list-style-type: none"> - Dimensional stability & accuracy - Excellent elastic recovery from deformation - Newer hydrophilic formulas improve wettability after set, improving pourability - Biocompatible
Disadvantages	<ul style="list-style-type: none"> - dimensional instability - difficult to disinfect without distortion – imbibition swelling - lack of detail reproduction when compared to other impress - single pour - cast must be removed from impress within one hour - not all are compatible with gypsum 	<ul style="list-style-type: none"> - poor dimensional stability - must pour immediately - limited shelf life - low tear strength - hydrophobic 	<ul style="list-style-type: none"> - “rotten egg” smell, unpleasant taste - lead in some formulations - limited period of dimensional stability - stains clothes - high potential for distortion 	<ul style="list-style-type: none"> - very rigid, difficult to remove from undercuts - opaque material makes it difficult to detect pressure spots - distorts with humidity and moisture - avoid immersion disinfection Expensive - possible patient allergy to alkyl benzene sulfonate 	<ul style="list-style-type: none"> - expensive - limited shelf life - poor adhesion between putty and wash - hydrogen gas release in some brands - low tear strength of low viscosity materials

Craig RG. Restorative dental materials, 10th ed. 1997: 310.

A properly-shaped occlusal or cingulum rest seat for a removable partial denture will provide:

- A. increased retention

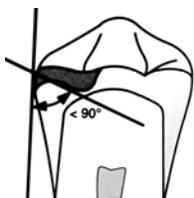
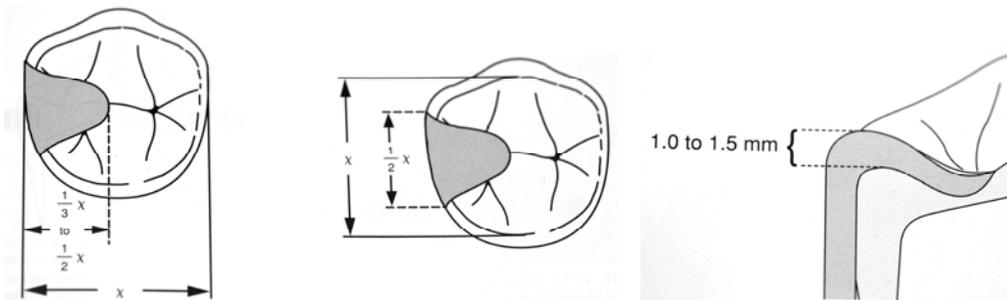
- B. flexibility to absorb stress
- C. resistance to vertical displacement
- D. definitive guidance for the path of insertion

Answer: C

Occlusal or cingulum rests function to prevent the vertical movement of the partial denture toward the soft tissues. Retainers are any type of clasp, attachment or device used to increase the retention of the denture. The stress-breaker or broken-stress attachment is applied to a device that allows some movement between the denture base or its supporting framework and the direct retainers, so as to provide flexibility for absorbing stress placed on the prosthesis.

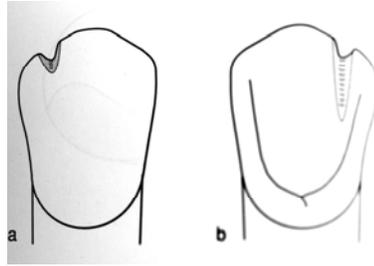
There are 3 major forms of rests: occlusal rests, lingual or cingulum rests or incisal rests. Primary rests prevent the vertical movement of prosthesis toward the tissues and also help transmit applied forces to the supporting teeth. occlusal surface.

- The outline form of an occlusal rest seat should be roughly triangular, with the base of the triangle located at the marginal ridge and the rounded apex directed toward the center of the An occlusal rest seat should occupy one third to one half the mesiodistal diameter of the abutment and approximately one half the buccolingual width of the tooth measured from cusp tip to cusp tip



The enclosed angle formed by a line dropped down the proximal surface of the tooth and the floor of the rest seat must be less than 90 degrees. This permits forces to be transmitted along the long axis of the abutment. The deepest portion of an occlusal rest should be located near the center of the mesial or distal fossa.

- Incisal rest seat should appear as a small, V-shaped notch located 1.5 to 2.0mm from the proximal-incisal angle of the tooth.



- Lingual or cingulum rests are used primarily on maxillary canines. The normal shape should be V shaped when viewed in cross section. This geometry prevents migration of the abutment away from the RPD framework.

Guiding planes are those parallel axial surfaces of abutment teeth created to provide definitive guidance during the insertion and removal of the partial denture. Of the four factors considered in determining the most favorable tilt of a cast, the development of guiding planes is the one that can be most easily compromised. They can be prepared on most enamel surfaces.

Phoenix R, Cagna D, Defreest C. Stewart's Clinical Removable Partial Prosthodontics, 3rd ed. Quintessence Publishing 2003:45-52; 227

What are the requirements of a clasp assembly?

- Passivity
- retention
- Stability
- support
- Rest seat
- Encirclement
- Infrabulge
- Reciprocation
- Rotation
- I-bar

- a, c, e, f, h, j
- b, c, f, g, i, j
- a, b, c, d, f, h
- a, b, c, d, e, f
- e, f, g, i, j
- all of the above
- none of the above

Answer: 3

The clasp assembly must be designed so that they satisfy the following seven requirements: retention, support, stability, reciprocation, encirclement, passivity and flexibility.

Retention – the quality of the clasp assembly that resists forces acting to dislodge components away from the supporting tissues.

Flexibility – the greatest amount of displacement that can occur without causing permanent deformation of the clasp arm. Flexibility may be influenced by length, cross-sectional form, cross-sectional diameter, longitudinal taper, clasp curvature, and metallurgical characteristics of the alloy.

Support – the quality of a clasp assembly that resists displacement of a prosthesis in an apical direction.

Stability – the quality of a clasp assembly that resists displacement of a prosthesis in a horizontal direction.

Reciprocation – the quality of a clasp assembly that counteracts lateral displacement of an abutment when the retentive clasp terminus passes over the height of contour. Lateral displacement is potentially harmful to the supporting periodontal tissues.

Encirclement – the characteristic that prevents movement of an abutment away from the associated clasp assembly.

Passivity – the quality that prevents the transmission of adverse forces to the associated abutment when the prosthesis is completely seated. When fully seated the clasp should be passive.

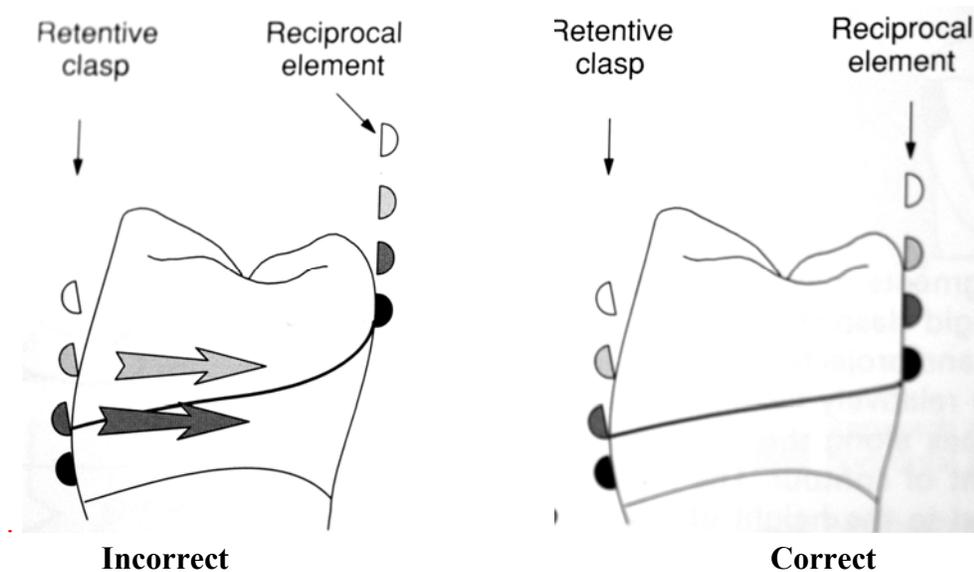
Phoenix R, Cagna D, Defreest C. Stewart's Clinical Removable Partial Prosthodontics, 3rd ed. Quintessence Publishing 2003:63-72.

**Ideally, in what portion of the tooth do you want the reciprocating arm to be located?
(select the answer that is most correct)**

- A. Occlusal third
- B. Gingival Third
- C. Middle third
- D. it doesn't matter, no need to re-contour the survey line.

Answer: C

The purpose of the reciprocating arm is to resist the lateral movement of the tooth. It can be a cast clasp, a lingual plate, or a combination of mesial and distal minor connectors. The reciprocal element during insertion, should contact the abutment at or occlusal to the height of contour.



Incorrect **Correct**

This illustration of the relationship between the retentive clasp arm and the reciprocal element while the clasp assembly is inserted. In each diagram, a retentive clasp and reciprocal element pair move apically from the starting position (white), to first tooth contact (light grey), to deformation of the retentive clasp (dark grey), and finally to complete seating (black).

When incorrectly related, as shown in the first image, the retentive clasp contacts the abutment and begins to deform before the reciprocal element contact can resist lingual displacement of the tooth. In this situation, the abutment will incur lingually directed stress (light and dark grey arrows) until the reciprocal element contacts the tooth (black) to resist displacement.

In the second image where the clasps are correctly related, the retentive clasp and reciprocal element contact the tooth simultaneously. The reciprocal element maintains contact with the abutment until the removable partial denture is completely seated. When this relationship exists, ideal design positions the retentive clasp terminus in the gingival third of the abutment and the reciprocal element at the junction of the middle and apical thirds of the tooth.

Phoenix R, Cagna D, Defreest C. Stewart's Clinical Removable Partial Prosthodontics, 3rd ed. Quintessence Publishing 2003:61-62; 70-73.

All of the following are required biomechanical components of removable partial denture clasp system except:

- a. Support**
- b. Adequate encirclement**
- c. Bracing**
- d. Cleansable**
- e. Passivity**

Answer: d

Biomechanical requirements for RPD clasps include each of the following components:

Retention - resistance to vertical dislodging. Provided by retentive clasp arms.

Bracing - resistance to horizontal, lateral or torsional components of force. Provided by rigid portions of clasps or other rigid components. Can be unilateral or bilateral.

Support - resistance to vertical seating forces. Provided by rest seats. Prevents trauma to the periodontal structures.

Reciprocation - resistance to horizontal forces exerted on the tooth by an active retentive element. Provided by the reciprocal arm (bracing arm).

Adequate encirclement - clasp should encircle abutment tooth more than 180°. This prevents horizontal tooth movement from within the confines of the clasp.

Passivity - There should be no active force on the abutment tooth when the clasp is fully seated. The retentive action should only be engaged when dislodging forces are present. The clasp should never grip the tooth.

Note: cleansability is not a required biomechanical component of clasp, but it is important to minimize tooth coverage with the clasp in order to improve cleansability and reduce plaque accumulation.

Reference: AJ Krol, TE Jacobson, FC Finzen. Removable Partial Denture Design Outline Syllabus. 4th Edition. 1990. pg. 47-50.

Which of the following statements are true concerning intracoronal attachments and RPDs?

- a. It is best to splint the abutment tooth containing an intracoronal attachment to adjacent teeth.**
- b. Frequent relines of distal extensions are necessary.**
- c. Intracoronal attachments are equally successful on either the maxillary or mandibular arches.**
- d. Have a higher potential to torque abutment teeth than traditional clasping systems when used for tooth-mucosa borne RPDs.**
- e. RPDs fabricated with intracoronal attachments have lower failure rates than RPDs fabricated with traditional clasps.**

1. a, b, c

2. a, b, c, d

3. a, b, d

4. All of the above

Answer: 3

Attachments for RPDs can include any of the following:

Precision - consist of a metal receptacle (matrix) and a close fitting part (patrix). Usually the matrix is placed within the normal or expanded contours of a crown on the abutment tooth and the patrix is on the pontic or denture framework.

Rigid - attachment does not permit movement or flexion between the matrix and patrix.

Nonrigid - attachment permits movement between the matrix and patrix via a spring-loaded mechanism, hinge, ball and socket mechanism or flexible cements.

Intracoronal - attachment is contained within the normal contours of the crown portion of a natural tooth.

Extracoronal - attachment extends outside or external to the crown portion of a natural tooth.

Advantages of attachments: Elimination of visible clasp arms.

Disadvantages of attachments: Additional expense, increased frequency of adjustment and failure, increased technical expertise needed, unpredictable or unfavorable distribution of forces.

Indications for attachments: When the esthetic demands of the patient cannot be satisfied using conventional partial dentures.

Contraindications for attachments: Esthetic demands can be satisfied using conventional clasp designs or a rotational path RPD, when control of the relative distribution of functional forces to the dento-alveolar and muco-osseous segments is critical to their preservation, when financial constraints exist, when regular patient recall is not possible.

Rigid attachments

Advantages - less susceptible to failure due to the absence of moving parts, reduced bulk due to design, effectively directs forces apically in tooth-borne RPDs, may provide effective splinting and cross-arch stabilization.

Disadvantages - may torque abutment teeth in tooth-mucosa borne RPDs, usually requires placement of a cast restoration on the abutment tooth to accommodate the matrix, usually requires a paralleling device to determine the exact path of placement.

Indications - Tooth borne RPDs when conventional designs are unacceptable, in tooth-mucosa borne RPDs when favorable muco-osseous support is available, in tooth-mucosa borne RPDs when abutment teeth demonstrate the potential to tolerate increased forces, in tooth-mucosa borne RPDs when high ridge resistance and high abutment resistance exist.

Nonrigid attachments:

Advantages - may reduce forces on abutment teeth, usually does not require a paralleling device to determine the path of placement, may not require placement of a cast restoration on the abutment tooth.

Disadvantages - Increased rate of failure of mobile or flexible components, increased expense, increased bulk or thickness of the prosthesis, potential increased forces directed to the distal extension segment.

Indications - in tooth-mucosa borne RPDs when reduced forces directed to the abutment teeth are required, in tooth-mucosa borne RPDs when favorable muco-osseous support is available, in tooth-mucosa borne RPDs when low abutment resistance and high ridge resistance exist.

Intracoronary attachments:

Advantages - Permit abutment tooth and prosthesis contours to be conducive to periodontal health, may be used when less interarch distance is available, promotes apically directed abutment tooth force transmission.

Disadvantages - increased tooth modification required to incorporate matrix, requires adequate occlusogingival dimensions of abutment tooth for elective fixation.

Extracoronal attachment:

Advantages - less extensive tooth modification, reduced requirement of occlusogingival height of abutment tooth.

Disadvantages - final contours of abutment tooth are less conducive to periodontal health, requires adequate interarch distance to accommodate the attachment mechanism and position of artificial teeth, usually compromises the potential to direct forces along the long axis of the abutment tooth.

Treatment planning considerations and requirements:

1. Potential for dento-alveolar support.
2. Potential for muco-osseous support.
3. Potential for applied forces.
4. Tooth-borne versus tooth-mucosa borne.

Design considerations for the tooth-mucosa borne RPD with a rigid intracoronal precision attachment:

Prerequisites - High esthetic demands, favorable dento-alveolar support, favorable muco-osseous support, normal potential of applied forces, potential for optimum pot-insertion maintenance.

Design and tx planning considerations - need optimum extension of denture bases to promote muco-osseous support for tooth-mucosa borne RPDs, use of the selective pressure impression technique or reline procedures to maximize muco-osseous support, horizontal coverage of the palate with the maxillary major connector to provide additional support, splinting for force distribution, establishing a functional matrix-patrix relationship, performance of a clinical remount to adjust occlusion and articulation, regular reline procedures at recall appointments to maintain muco-osseous support.

Reference: AJ Krol, TE Jacobson, FC Finzen. Removable Partial Denture Design Outline Syllabus. 4th Edition. 1990. pg. 185-92.

Match the following RPD rotational path design with the appropriate category:

_____ 1. An A-P rotational path replacing posterior teeth.

a. Category 1

- _____ 2. A P-A rotational path replacing posterior teeth. **b. Category 2**
- _____ 3. A lateral rotational path utilizing proximofacial undercuts.
- _____ 4. All A-P rotational paths replacing missing anterior teeth.
- _____ 5. A lateral rotational path utilizing proximolingual undercuts.

Answers:

1. a
2. a
3. b
4. b
5. a

Types of rotational path RPDs:

1. Anteroposterior (A-P) - Anterior segment is seated first.
2. Posteroanterior (P-A) - Posterior segment seated first.
3. Lateral - The edentulous side is seated first, followed by seating of the opposite side.

Categories of rotational path designs:

1. Category 1
 - a. Rotational centers are located at the termini of the extended rests of the rigid retainers.
 - b. The rotational centers on each side of the arch determine the axis of rotation for placement of the partial denture.

- c. The rotational centers are seated first then the prosthesis is rotated into place.
- d. Includes A-P and P-A paths of rotation replacing missing posterior teeth, and lateral paths of rotation utilizing proximolingual undercuts.

2. Category 2

- a. Rotational centers are located at the gingival extensions of the rigid retainers.
- b. The rotational centers on each side of the arch determine the axis of rotation for final placement of the partial denture.
- c. To gain access to the rotational centers, the segment with rigid retainers is seated first along a straight path. The prosthesis is then rotated into place.
- d. Includes all A-P paths of rotation replacing missing anterior teeth and all lateral paths of rotation utilizing proximofacial undercuts.

Reference: AJ Krol, TE Jacobson, FC Finzen. Removable Partial Denture Design Outline Syllabus. 4th Edition. 1990. pg. 71.

All of the following are possible causes for swallowing difficulty after delivery of new complete dentures except:

- a. Mandibular posterior lingual flange is overextended or too thick.**
- b. Maxillary posterior border is overextended or too thick.**
- c. Inadequate OVD.**
- d. Excessive OVD.**

Answer: c

ENDODONTICS

Troubleshooting

<u>Complaint:</u>	<u>Cause:</u>	<u>Treatment:</u>
1. Sore spots:		
A. Vestibule:	Overextended borders:	Identify pressure with disclosing wax or PIP & relieve.
	Inadequate frenum relief:	Identify with disclosing wax & reduce.
	Occlusal prematurities:	Patient remount & equilibrate.
B. Posterior border of maxillary denture:	Deep posterior palatal seal:	PIP, reduce & polish, carefully!
	Sharp posterior palatal seal:	PIP, round & polish, carefully!
	Overextension:	Locate correct position, transfer to CD with indelible pencil & reduce.
C. Ridges: (generalized)	Malocclusion:	Patient Remount.
	Excessive OVD:	Patient remount to lower OVD, or make new CD's.
	Inaccurate denture base:	Reline, rebase or new CD's.
D. Ridges: (localized)	Occlusion (most common)	Patient remount.
	Resin spicule;	PIP & reduce.
	Inaccurate denture base:	Reline or rebase & patient remount.
E. Mandibular lingual or buccal flange:	Occlusion: lateral interference:	Patient remount.
	Overextension:	Disclosing wax, adjust & polish.
F. Mandibular labial flange:	Occlusion: anterior CR or protrusive interference:	Patient remount.
	Overextended	Disclosing wax, adjust & polish:
G. Denture stomatitis:	Candidiasis:	Treat accordingly:
H. Angular cheilitis:	Denture stomatitis:	Treat the candidiasis:
I. Denture sore mouth:	Systemic Alcoholism Psychological:	Rule out dental origin & refer accordingly.

2. **Gagging:**

- A. **Immediate:**
- Overextended or underextended maxillary posterior border: Identify the involved border, reduce or add as indicated.
 - Maxillary posterior border too thick: Reduce & polish.
 - Excessive OVD: Patient remount, adjust to lower OVD or remake CD's.
 - Overextended mandibular distolingual flange: Disclosing wax, reduce & polish.
- B. **Delayed:**
- Inadequate posterior palatal seal: Reestablish, process, remount & polish.
 - Malocclusion: Patient remount.
 - Poor retention: Reline & remount.
 - Alcoholism: Refer.
- C. **Always:** Psychogenic: Refer:

3. **Muscle soreness/ TMJ symptoms:**

- Inadequate OVD: Establish correct OVD, reline or rebase and remount.
- Excessive OVD: Reduce OVD by remount or remake.
- Malocclusion: Patient remount or new CD's.

4. **Burning sensation:**

- A. **Anterior hard palate & ridge:** Pressure on anterior palatine foramen: PIP & relieve.
- B. **Mandibular anterior area:** Pressure on mental foramen: PIP & relieve.
- C. **Maxillary premolar & molar tuberosity:** Pressure on posterior palatine foramen: PIP & relieve.
- D. **Generalized:**
- Denture base allergy: Completely cured during processing? Refer to allergy clinic for verification.
 - Ill fitting dentures: Reline, rebase or remake.
- E. **Burning tongue:** Systemic problem: Refer to confirm.
Vitamin deficiency, endocrine, psychological.

5. **Trouble Swallowing:**

- Mandibular posterior lingual flange overextended (usually with sore throat) or too thick: Reduce the overextension or thin the border.
- Maxillary posterior border overextended or too thick: Reduce the overextension or thin the border.
- Excessive OVD: Remount & adjust for lower OVD or make new CD's.

6. Denture Instability:

- A. When out of occlusion:
(constant)
- | | |
|--|--|
| Overextended borders | Disclosing wax & adjust. Border mold, reline & remount. |
| Underextended borders: | Border mold or place functional wax, reline & remount. |
| Poor post dam: Check by pushing up on edges of #'s 8 & 9: | Border mold or place functional wax, reline & remount. |
| Poor hamular notch adaptation: Check by pushing up on canine-premolar area on opposite side: | Border mold or place functional wax, reline & remount. |
| Large weight loss: | Reline, rebase or remake. |
| Dehydration, alcoholism: | Refer. |
| Abused &/or distorted hyperplastic tissues: | Tissue conditioning, surgery, reline or rebase & remount, or new CD's. |
- B. While eating:
(During functioning)
- | | |
|-----------------------------------|---|
| Poor post dam or hamular notches: | Border mold or place functional wax, reline & remount or make new CD's. |
| Anterior teeth too far labially: | Reset anterior teeth. |
| Posterior teeth too far buccally: | Reset posterior teeth. |
| Unilateral chewing: | Patient education. |
- C. When in CR occlusion:
- | | |
|------------------------------------|--|
| Malocclusion : | Patient remount. |
| Pressure on median palatal suture: | PIP & relieve. |
| Flabby tissues | Surgery, reline & remount, or make new CD's. |
| Contact on overdenture abutments | PIP, relieve & functional reline of the abutments. |
7. Tongue &/or Cheek Biting:
- | | |
|--|--|
| Posterior teeth set edge to edge, too far lingually or buccally: | Reset posterior teeth for correct relation, process & remount. |
| Inadequate OVD: | Reline at correct OVD & remount. |
8. Clicking:
- A. During speech:
- | | |
|-----------------|--|
| Excessive OVD: | Remount & adjust to lower OVD or make new CD's |
| Poor retention: | See section 6 |
- B. During swallowing or at the termination of speech:
- | | |
|---|---|
| Mandibular CD overextended in retromolar pad areas: | Use tissue marker to identify the pads and adjust: Keep the retromolar pad covered. |
| Porcelain teeth: | Replace with resin teeth. |
9. Fullness under nose:
- | | |
|------------------------------------|----------------------------|
| Maxillary teeth too far lingually: | Disclosing wax and reduce. |
|------------------------------------|----------------------------|
10. Depressed nasolabial sulcus or philtrum:
- | | |
|------------------------------------|--|
| Maxillary teeth too far lingually: | Reset maxillary anterior teeth or make new CD's. |
| Short, thin labial flange: | Border mold, process and remount. |

11	Teeth show too much: (Too visible)	Excessive OVD: High or low occlusal plane: Teeth too far labially: No buccal corridor:	Reduce OVD with patient remount or remake. Reset teeth or remake. Reset teeth or remake. Reset posterior teeth or remake.
12	Looks artificial:	"Perfect" alignment: Too bright, monochromatic: Teeth look "younger": Gingival acrylic looks funny;;	Rotate & tilt the teeth. Select lower value shade, mix shades. Custom grind to simulate wear, place restorations. Custom festoon & characterize denture bases.
13	Whistle:	Palate too narrow: Maxillary premolars too far medially:	Make palatogram (PIP), & grind to widen. Must have sufficient thickness of resin Reset the teeth.
14	Sounds like "Sh":	Anterior palate too broad: Incorrect closest speaking space:	Add wax (rugae?) & process. Reset Maxillary & mandibular anterior teeth.
15	Sounds like "Th":	Inadequate interocclusal distance: Maxillary teeth too far lingual:	Remount & reduce OVD or make new CD's. Reset the teeth.
16	Poor "F" & "V" sounds:	Maxillary anterior teeth positioned incorrectly:	Reset the teeth.

Reference: G.A Zarb, C.L. Bolender, S.C. Hickey, G.E. Carlsson. Boucher's Prosthodontic Treatment for Edentulous Patients. Tenth Edition. 1990. Pg 509-18, 382-424.

Which of the following statements is true concerning reciprocation in RPDs?

- a. The reciprocal arm counteracts forces of the retentive arm throughout the entire movement from insertion to fully seated.
- b. The reciprocal arm counteracts the force placed on the abutment tooth as the retentive arm passes over the height of contour on the opposite side of the tooth.
- c. The reciprocal arm is only active when the retentive arm is fully seated in the undercut below the height of contour.

Answer: b

Reciprocation is resistance to horizontal forces exerted on a tooth by an active retentive element. It is provided by rigid bracing components contacting the surface of the tooth opposite the retentive clasp arm. It opposes forces exerted by the retentive clasp arm terminal through its action distance during seating and unseating of the prosthesis. More importantly it prevents tooth movement that may result from over adjustment of the retentive clasp arms.

Reference: AJ Krol, TE Jacobson, FC Finzen. Removable Partial Denture Design Outline Syllabus. 4th Edition. 1990. pg. 48.

Match the following metals with their properties:

- | | |
|------------------------------|---|
| 1. Nickel | A. Oxide scavenger |
| 2. Cobalt | B. Hardener |
| 3. Chromium | C. Tarnish/corrosion resistance |
| 4. Molybdenum | D. Reduce fusion temperature |
| 5. Manganese (small amounts) | E. Requires a positive exhaust when cutting, grinding and polishing |
| 6. 0.5% Silicon | F. Increases ductility |
| 7. Copper | G. Increases strength |
| 8. Beryllium | |

Answer:

1. Nickel: F. Tends to increase ductility, especially when used instead of cobalt.
2. Cobalt: G. Increases Strength
3. Chromium: C. Tarnish/corrosion resistance
4. Molybdenum: B. Hardener
5. Manganese: A. Oxide scavenger and also acts in solid solution hardening
6. Silicon: A. Oxide scavenger
7. Copper: D. and B. Reduce fusion temperature and grain size and increases hardness
8. Beryllium: D and B and E: Same as copper, but also needs adequate exhaust.

Most of the removable alloys used today have chromium in a concentration between 12 and 30 percent. Chromium has a passivating effect that ensures corrosion resistance of the alloy by creating a thin, transparent, tough and adherent layer of chromium oxide on the surface of the alloy. This nonreactive layer inhibits further oxidation of the underlying alloy. Copper and beryllium are more commonly found in the nickel-chromium rather than the cobalt-chromium alloys. They

reduce fusion temperatures and increase hardness. Thirty percent chromium is considered the upper limit for attaining maximum mechanical properties. Beryllium is a hardener and grain structure refiner, but its biggest contribution is generally to reduce the fusion temperature. Aluminum forms a nickel-aluminum compound that effects precipitation hardening in the alloys that are principally nickel-based. Carbon can also increase material strength, but can also create brittleness when used in too great an amount. These alloys all have a density less than half that of dental gold alloys. By altering their compositions, different properties can be altered to adjust to the needs of the patient. Ticonium is a nickel-containing alloy used in the U.S. Navy that has good working properties. For nickel-sensitive patients, Vitallium can be substituted.

Phillips, Skinner's Science of Dental Materials, 9th ed, W.B. Saunders Company p. 366,376-378

Phillips, Elements of Dental Materials, 4th ed., W.B. Saunders Company, p. 354-355

Which ones of the following can cause Xerostomia?

1. Antihypertensives
2. Aging
3. Antispasmodics
4. Sialogogues
5. Atropine
6. Vitamin A deficiency
7. Vitamin B complex deficiency
8. Sjogren's syndrome

Answer: 1,3,5,6,7 and 8

The lubricating ability of saliva in the mouth has a direct relationship to the comfort of the patient wearing dentures. Denture retention is compromised due to the loss of hydrostatic effect; however, the tissues tend to stick to the dentures in isolated spots leading to mucosal soreness or ulcerations. Salivary flow also facilitates mastication, formation of the bolus and swallowing. Xerostomia is a manifestation of gland dysfunction from many possible causes. Management depends on the cause. Antihypertensives and antispasmodics block receptors that stimulate salivary flow. Atropine blocks the action of acetylcholine which also leads to a decrease in salivary flow. Sjogren's syndrome is an autoimmune disorder that involves destruction of the body's own tissues and leads to dryness in many areas. Sialogogues STIMULATE salivary flow and can treat xerostomia. Aging has not been shown to cause xerostomia, but many elderly patients have xerostomia due to the greater probability that they will have experienced one of the many causes of the condition.

Zarb, Bolender and Carlsson, Boucher's Prosthodontic Treatment, 11th ed, Copyright Mosby, 1997, p. 110-111

In using a lingualized articulation, what adjustments would be made for a patient who does not demonstrate an easily reproducible Centric Relation?

- a. Maximum Contact with bilateral balance and no overjet
- b. Controlled Contact with bilateral balance and 1 mm overbite/overjet
- c. Maximum Contact with no over-bite
- d. Controlled Contact with greater freedom of movement around maximum intercuspation.

Answer: d. Controlled Contact with freedom of movement

The Controlled Contact (CC) differs from the Maximum Contact (MC) molds in the maxillary posterior teeth. The mandibular teeth are designed with lower cusp heights and multiple occlusal spillways to assist in mastication. The CC upper posterior teeth are designed to provide for greater freedom of movement in MI. If jaw relationship records are easy to obtain, MC teeth may be chosen. MC teeth have the advantage of being more anatomical in appearance with greater cusp heights, but often require more refinement of the occlusal fossae and marginal ridges of the mandibular teeth. In any case, lingualized integration is based on the use of the maxillary lingual cusp as the main supporting cusp. These cusps have to glide from maximum intercuspation over the opposing teeth without any deflection during nonrestrictive lateral and protrusive movements. Zarb, Bolender and Carlsson, Boucher's Prosthodontic Treatment, 11th ed, Copyright Mosby, 1997, p. 254-256

What does whistling while a patient is speaking indicate?

- a. Joyful graduation from residency program
- b. The space between the tongue and the alveolus is too large
- c. The space between the tongue and the alveolus is too small
- d. The teeth are meeting edge to edge in a horizontal relationship

Answer: c. The opening is too small.

Not a. We won't be able to speak. All you're going to get is a babbling sound. If the opening is too large or too broad, the s will come out as "sh". A whistle is also caused by a posterior dental arch form that is too narrow. Creation of a sharp s requires accuracy of the neuromuscular control system. A groove for air-flow must be controlled and the air directed correctly. With MOST people, this is with the tip of the tongue against the alveolus in the area of the rugae, but not with everyone. Even small deviations of 1 mm can influence the quality of the sound, and so some adjustment will probably be needed for the denture wearer. Things that can help: make sure the teeth do not touch the upper front teeth and make sure that the palatal form is not too narrow...

Johnson and Stratton, Fundamentals of Removable Prosthodontics, Quintessence Publishing co., inc, 1980 P423

Which answer (s) is/are not an **advantage** of using a cast chromium-cobalt alloy for removable partial denture frameworks?

- A. High corrosion resistance
 - B. Moderate ductility
 - C. High density
 - D. High strength
-
- 1. C
 - 2. A & D
 - 3. B & D
 - 4. B & C
 - 5. A

Answer is: **4. B & C**

Chromium-cobalt alloys are quite inflexible which means they essentially have **no ductility** or malleability after they are cast. The popularity of chromium-cobalt alloys can be attributed to their **low density (weight)**, high modulus of elasticity (stiffness), low material cost and **high resistance to corrosion**.

Composition of Chromium alloys:

Chromium-ensures that the alloy will resist tarnish and corrosion (due to complex chromium oxide formation).

Cobalt-contributes strength, rigidity and hardness

Nickel-increases ductility

Minor constituents-carbon has a pronounced effect on the strength, hardness, and ductility. Tin, Indium and other readily oxidized minor components of the alloy function to improve bonding.

Reference:

Daher T, et al. Designing successful removable partial dentures. *Compendium*. March Vol. 27(3) 2006, pp 186-194.

Which primary design-quality of the occlusal rest would categorize it as a “positive” rest?

- A. Allow no tilting of the appliance
- B. Prevent the movement of the appliance
- C. Transmit stress down the long axis of the tooth
- D. Form acute angles with the minor connectors
- E. Have a thickness of 1.5 mm
- F. None of the above

Answer is: **D**

By forming acute angles with the minor connectors that connect them to the major connectors it defines the positive rest and also permits maximum bracing. The primary purpose of the rest is to provide vertical support for the RPD.

Form of the occlusal rest and rest seats:

1. The outline form should be a “rounded” triangular shape with the apex toward the center of the occlusal surface.
2. It should be as long as it is wide and the base of the triangular shape should be at least **2.5 mm** for both molars and premolars.
3. The marginal ridge of the abutment tooth at the site of the rest seat must be lowered to permit a sufficient bulk of metal for strength and rigidity. This means that a reduction of the marginal ridge of about **1.5 mm** is usually necessary.
4. The floor of the occlusal rest should be apical to the marginal ridge and be concave or spoon shaped (no sharp edges or line-angles in the prep).
5. The angle formed by the occlusal rest and the vertical minor connector from which it originates should be **less than 90 degrees.**
6. The rest must be **rounded** (spoon shaped) to permit functional movement.

Reference:

Luk NK, et al. Mathematical analysis of occlusal rest design for cast removable partial dentures. *Eur J Prosthodont Restor Dent* 2007 15:1 29-32.

The primary indicator of the accuracy of border molding is:

- A. Adequate coverage of tray borders with the material used for border molding
- B. Contours of the periphery similar to the final form of the denture
- C. Stability and lack of displacement of the tray in the mouth
- D. Uniformly thick borders of the periphery

The answer is: **C**

The ease and accuracy of the border molding depends upon:

1. An accurately fitting custom tray
2. Control of bulk and temperature of the modeling compound
3. A thoroughly dried tray

The custom tray fabricated on the preliminary cast is trimmed approximately 2 mm short of the mucosal reflection and frenae. This is done by first checking the borders in the mouth and then

trimmed down. This will allow a uniform thickness of 2 mm of modeling compound when borders are molded. Proper border molding results in **contours resembling the final form of the denture**. However, the **primary indicator of the accuracy of border molding is the stability and lack of displacement of tray in the mouth**.

Reference:

Petrie CS, et al. A survey of U.S. prosthodontists and dental schools on the current materials and methods for final impressions for complete denture prosthodontics. J Prosthodont. 2005 Dec;14(4):253-62.

A patient has worn a complete maxillary denture for 8 years against mandibular anterior teeth (the remainder of the mandibular teeth are missing). She complains of looseness of the denture. Examination of the mouth shows an excessive amount of hyperplastic tissue at the anterior part of the maxillary ridge. The maxillary denture teeth do not show below the upper lip. Radiographs show poor bone structure in the anterior part of the maxillae. The principal cause of difficulty with her maxillary denture is?

- A. Fibrous tuberosities
- B. Too great a vertical dimension of occlusion
- C. A lack of posterior occlusion
- D. The maxillary denture teeth that were used are too short.

The answer is: C

The patient's chief complaint will be looseness of the maxillary denture. They will also state that they can no longer see their upper teeth on the denture. These signs and symptoms are caused by a lack of posterior occlusion.

A patient wearing a maxillary complete denture and a mandibular bilateral distal-extension removable partial may show:

1. Decreased vertical dimension of occlusion
2. A prognathic facial feature

When a complete maxillary denture opposes natural mandibular anterior teeth, the maxillary anterior ridge often becomes very flabby.

Ellsworth Kelly was the first person to use the term 'Combination Syndrome'. Kelly originally described Combination Syndrome in a sample of patients with complete maxillary dentures, opposing natural mandibular teeth and a distal extension RPD. He described five signs or symptoms that commonly occurred in this situation. They include:

1. Loss of bone from the anterior part of the maxillary ridge.

2. Overgrowth of the tuberosities.
3. Papillary hyperplasia in the hard palate.
4. Extrusion of the lower anterior teeth.
5. The loss of bone under the partial denture bases

Reference:

Nakamura K. A case of occlusal reconstruction for disintegration of occlusion. *Nihon Hotetsu Shika Gakkai Zasshi*. 2006 Apr;50(2):256-9.

It is important that a wrought wire clasp have an elongation percentage of:

- A. More than 25%, allowing the clasp to bend without microstructure changes that could compromise its physical properties.
- B. More than 6%, allowing the clasp to bend without microstructure changes that could compromise its physical properties.
- C. Less than 6%, allowing the clasp to bend without microstructure changes that could compromise its physical properties.
- D. Less than 25%, allowing the clasp to bend without microstructure changes that could compromise its physical properties.

The answer is: **B**

A **wrought wire** clasp is fabricated by drawing the metal from which it is made into a wire. The success of wrought wire clasps depends on their physical properties and the changes that may occur during fabrication. Laboratory procedures can compromise desirable physical properties due to improper heating and cooling. Manufacturers directions should be followed for each particular alloy. It is important that a wrought wire clasp have an **elongation percentage of more than 6%**, allowing the clasp to bend without microstructure changes that could compromise its physical properties. Tapering a wrought wire clasp to 0.8mm at the tip before contouring allows for more uniform stress distribution throughout the clasp, making it more serviceable and efficient. **Remember:** The **most important** mechanical property involved when a clasp is adjusted is **elongation**.

Advantages of **wrought wire** clasps (gold or cobalt-chromium) over clasps of the same composition: **Higher yield strength----Greater flexibility----More ductile----More resilient**

References:

Kim d, et al, Comparison of cast Ti-Ni alloy clasp retention with conventional removable partial denture clasps. *J Prosthetic Dent.* 2004 Apr;91(4):374-82.

What would be some indication(s) for removable partial dentures (RPDs)?

- a. long span for fixed prosthesis
- b. need to restore soft and hard contours
- c. absence of adequate periodontal support
- d. structurally or anatomically compromised abutment teeth
- e. a, b, c
- f. all of the above

Answer:

- f. all of the above

Another reasons for considering RPDs instead of fixed partial dentures:

- need for cross arch stabilization
- structurally or anatomically compromised abutment teeth
 - 1. lack of clinical crown height
 - 2. lack of sound tooth structure
 - 3. unfavorable position, contour or inclination
- need for an extension base
- anterior esthetics
- physical and emotional problems precluding fixed partial dentures.
- attitude and desires of the patient
- ease of plaque removal from the natural teeth and partial denture

Krol A, Jacobson T, Finzen F. Removable Partial Denture Design Outline syllabus. 1999: p-5

Which of the following are true about Epulis fissuratum:

- a. it is an inflammatory fibrous hyperplasia
- b. found most commonly in the mucobuccal fold
- c. arise secondary to irritation from a denture flange

- d. lesions might be ulcerated
- e. a and b
- f. all of the above

Answer:

- f. all of the above

Epulis fissuratum:

-manage by:

- excision and biopsy to rule out possible malignancy
- reline or remake the ill fitting prosthesis
- histologically the lesions are composed of an increased quantity of fibrous tissue with varying numbers of chronic inflammatory cells, which are predominately plasma cells
- changes in the underlying minor salivary glands, ranging from a nonspecific sialadenitis to a papillary oncocytic ductal hyperplasia, are often seen

Reference: Marx R, Stern D. Oral and maxillofacial pathology a rationale for diagnosis and treatment. 2003; p20

Alginates – problems, imbibition and syneresis:

To decrease the setting time of an alginate mix, what would be the most logical choice?

- a. Increase in mixing water volume
- b. Increase in mixing water temperature
- c. Increase in powder/water ratio
- d. Increase in spatulation time

Answer: b

Alginates or irreversible hydrocolloids are sodium or potassium salts of alginic acid and therefore water soluble. They react with calcium sulfate to produce insoluble calcium alginate. **The reaction rate can be controlled by varying the temperature of the mixing water. Rate of set is doubled by an increase of 10 C.** Absorbs liquid by **imbibition** and it gives off by **syneresis** water and salts to the atmosphere causing distortion of the impression. That's why impressions should be poured immediately. A greater bulk of material produces a more accurate impression. A bulky impression has more favorable surface area/volume ratio and it is less

susceptible to water loss or gain and therefore unwanted dimensional change. The tray should be removed 2-3 min. after gelation. Some become distorted if left in the mouth more than 2-3 min. Teasing or wiggling the set impression from the mouth causes distortion as a result of viscous flow. Trimming off gross excess impression material before setting the tray down on the bench top is helpful. Distortion of irreversible hydrocolloids can occur if any part of the impression is unsupported by the tray or if there is movement of the tray during setting.

To ensure accuracy, pouring should be completed within 15 min. after the impression is removed from the mouth.

To achieve maximum strength and surface detail, the poured impression should be covered with wet paper and stored in a humidifier for 1 hour. The setting gypsum cast should never be immersed in water due to the hygroscopic expansion (it would double or triple the setting expansion of plaster, stone or die stone). For best results, the cast should be separated 1 hour after pouring.

Reference: Rosentiel, Land, Fujimoto. Contemporary Fixed Prosthodontics. Elsevier. 2006;p 43-44

What is the name of the line connecting the two distal-most retentive clasp tips in a Kennedy class I or II RPD?

- a. Fulcrum line axis.
- b. Longitudinal axis.
- c. Vertical axis.
- d. Retentive fulcrum line axis.
- e. Worm's axis.

Answer: d. Retentive fulcrum line axis.

The fulcrum line axis connects the two most distal rest seats in a distal extension RPD. Rotation around this axis occurs when the patient bites on both distal extension areas simultaneously (bilateral seating forces). Rests, the denture base, maxillary major connectors and non-stress-releasing clasp assemblies help prevent this kind of movement. In designing a RPD, the indirect retainer should be placed on a tooth that would form a 90° line with this axis, if the two were connected.

The longitudinal axis runs along the ridge crest. Rotation around this axis occurs with unilateral seating forces (ie: chews on one side), and tends to dislodge the contralateral side of the RPD. These forces are counteracted by

the denture base, maxillary major connectors, minor connectors, clasp assemblies, rests and artificial tooth placement.

The vertical axis is located near the center of the arch, and rotation about it occurs when lateral forces are placed on distal extension bases – giving a fishtailing type of movement. This rotation is counteracted by the denture base, maxillary major connectors, minor connectors, and clasp bracing components.

The retentive fulcrum line axis runs between the two distal-most retentive clasp tips in a distal extension RPD. Vertical dislodging forces cause these clasps to engage, and rotation about this occurs only if there is no indirect retainer present. Direct and indirect retainers, guide planes and minor connectors help to offset this type of rotation.

There is no such thing as Worm's axis concerning RPD's.

Reference: Krol AJ, Jacobson TE, Finzen FC. *Removable partial design: outline syllabus*. 5th Ed. Indent. 1999.

Early formulations of polyvinylsiloxane impression material released hydrogen gas from the surface of the impression, resulting in voids on the surface of the cast. This problem has been minimized by the addition of which element(s)? Select all that apply.

- a. Ruthenium.
- b. Indium.
- c. Platinum.
- d. Palladium.
- e. Kryptonite.

- 1. a and b.
- 2. a and c.
- 3. c and d.
- 4. b and e.
- 5. d only.

Answer: 5. d only.

PVS works when a silicone paste with terminal silane groups is combined with a silicone paste with terminal vinyl groups and a chloroplatinic acid catalyst. Addition of silane hydrogen groups across double bonds produces no by-products and forms an exceptionally stable end product. Some early formulations did release some hydrogen gas, but this is offset in today's formulations by the addition of palladium.

Ruthenium and indium are used as grain refiners in dental casting alloys; both also increase the hardness of the alloys.

Platinum adds toughness, ductility, and malleability to alloys.

Kryptonite has more of an effect on Superman than dental casting alloys or PVS.

References:

- Craig RG, Powers JM. *Restorative dental materials*. 11th Ed. Mosby, Inc. 2002.
- Schillingburg HT, *et al.* *Fundamentals of fixed prosthodontics*, 3rd Ed. Quintessence Publishing Co, Inc. 1997. pp. 269-272.

Which of the following impression techniques for making a final complete denture impression results in the least amount of detail on the master cast?

- a. Mucostatic.
- b. Anatomic.
- c. Selective pressure.
- d. Functional.

Answer: d. Functional.

A functional impression records the shape of the patient's mouth over a period of time and is a static representation of the dynamic forces placed on the tray and impression material. This impression lacks the fine detail seen with other techniques.

A mucostatic impression captures the fine details of the tissue using a fast-set material in an unloaded state (ie: ZOE).

An anatomic impression captures the hard tissues in an unloaded state; unfortunately, it tends to distort and overextend soft tissue areas.

A selective pressure technique is preferred in many cases as it allows the primary denture bearing areas (posterior ridges and tuberosities for the maxilla, buccal shelves and retromolar pad areas in the mandible) to be selectively loaded while the secondary supporting areas are not subjected to as much force. The secondary supporting areas are the anterior ridge and midline raphe in the maxilla and anterior and posterior ridges in the mandible. This helps to simulate tissue conditions under function and helps the final prosthesis to fit better.

Reference: Krol AJ, Jacobson TE, Finzen FC. *Removable partial design: outline syllabus*. 5th Ed. Indent. 1999.

An altered master cast impression is always indicated in maxillary distal extension RPD cases.

- a. True.
- b. False.

Answer: b. False.

For tooth-mucosa borne (ie: distal extension or Kennedy class I-II) RPD's, recording the edentulous segments independent of the teeth helps to improve the accuracy and fit of the prosthesis after delivery due to the different "squishiness" of the two tissue areas. Mucosal areas tend to compress about 13x more than tooth-supported areas.

An altered cast technique is indicated in these cases. An anatomic impression is made and the framework fabricated. Custom trays are made for the distal extension areas and are border molded at the subsequent visit once the fit of the framework is confirmed. The edentulous segments are then re-impressed using the combination framework-custom tray apparatus. The distal extension segments of the master cast are then removed, the framework and trays placed on the dentate part of the original master cast, and the newly impressed ridges are re-poured. This is required in many cases in the mandible, but rarely indicated in the maxilla due to the improved bony support from the palate.

When a one-stage impression technique is used in the mandible, a reline is usually indicated within a few months of delivery. A one-stage procedure used in this case may be referred to as an *anatomic impression* as it captures the hard tissues in an unloaded state; unfortunately, it tends to distort and overextend soft tissue areas.

Reference: Krol AJ, Jacobson TE, Finzen FC. *Removable partial design: outline syllabus*. 5th Ed. Indent. 1999.

Which of the following should NOT be considered when designing a RPD?

- a. Preservation of teeth and peridental structures.
- b. Minimizing tooth and gingival coverage.
- c. Potential loss of remaining teeth.
- d. Desires of the patient.
- e. None of these.

Answer: E. None of these.

All of the following should be considered in RPD design:

- Preservation of teeth and peridental structures and maintenance of their health in the long term.
- Minimal coverage of teeth and gingiva to help reduce plaque accumulation.
- The relative amounts of tooth-borne and tooth-mucosa-borne areas in the arch.
- Anatomic limitations like exostoses, undercuts, or anomalies.
- The inclination, position and contour of teeth.
- Contingency situations, like the loss of one or more teeth.
- The forces likely to be placed on the prosthesis by the patient.
- Ease of placement and removal based on patients mental status and dexterity.
- Esthetics.
- Desires of the patient.
- House classification (philosophical, exacting, indifferent, hysterical – remember, hysterical patients are NOT fit to wear dentures!)

Reference: Krol AJ, Jacobson TE, Finzen FC. *Removable partial design: outline syllabus*. 5th Ed. Indent. 1999.

Which of the following contribute to the retention of a complete denture?

- Interfacial surface tension as defined by Stefan's Law:

$$F = (1.5V\pi kr^4)/h^3$$
, where r = the radius of two circular plates, k = the viscosity of the incompressible fluid between them, h = the thickness of the plates, and V = the velocity required to pull the plates apart in a direction perpendicular to their radius.
- Adhesion.
- Cohesion.
- Oral and facial musculature.
- Atmospheric pressure.
- Undercuts, rotational insertion paths and parallel walls.
- Gravity.
- All of these.
- b, c, d, e, f and g only.

Answer: h. All of these.

Interfacial surface tension established when saliva is located between the tissue and the intaglio surface of a denture is a major retentive factor.

Charged salivary glycoproteins help develop adhesive forces between these two objects, while cohesive forces play a more minor role.

Oral and facial musculature contributes to retention as long as the teeth and denture bases are placed into harmony with the surrounding tissues.

Atmospheric pressure contributes when a denture is sealed around its periphery; so long as removal forces do not exceed atmospheric pressure, the seal will be maintained.

Gravity contributes to retention of the mandibular, but not the maxillary denture.

Reference: Zarb, Bolender. *Prosthetic treatment for edentulous patients: complete dentures and implant-supported prostheses*. 12th Ed. Mosby. 2004.

OPERATIVE

If a reversible hydrocolloid impression is left to stand for a short time, the surface may appear to be wet. This phenomenon of exuding moisture onto the surface is called:

- a. hysteresis
- b. imbibition
- c. syneresis
- d. condensation

Answer: C

Hydrocolloid is approximately 85% water and the balance of this constituent is critical to the impression's accuracy. It can lose water by syneresis. The water content of agar-type hydrocolloid impression materials is most important for dimensional stability

This is one of the reasons that alginate impressions should be poured up immediately. Alginate-type hydrocolloid impression materials are influenced by syneresis, imbibition, strain, and stress in the same way as the agar-type materials. Hence, for the most accurate results, the impression should be fixed and the cast poured soon after the impression is removed from the mouth. If the impression must be stored for a short period of time, it should be placed in a humidior in which the relative humidity is 100 percent.

Syneresis - When an impression made of this material is removed from the mouth into the air at room temperature, the surface contracts by giving off water to the air. This process is called syneresis and causes the outer layer of the impression to shrink and become distorted.

Imbibition - If the impression is placed in water, it will expand (take up water). This process is called imbibition. Unfortunately, the expansion caused by imbibition will not restore an impression to its original dimensions.

Ingredients in an Alginate Impression Powder and Their Functions. (*Craig et al, 11th ed, p335*)

Ingredient	Weight (%)	Function
Potassium alginate	18	To dissolve in water and react with Ca ions
Calcium sulfate dehydrate	14	To react with potassium alginate to form an insoluble Ca alginate gel
Potassium sulfate, Potassium Zinc fluoride, Silicates, or borates	10	To counteract inhibiting effect of the hydrocolloid on the setting of gypsum, giving a high-quality surface to the die.
Sodium phosphate	2	To react preferentially with Ca ions to provide working time before gelation
Diatomaceous earth or Silicate powder	56	To control the consistency of the mixed alginate and the flexibility of the set impression

Organic glycols	Small	To make the powder dustless
Wintergreen, peppermint	Trace	To produce a pleasant taste
Pigments	Trace	To provide color
Disinfectants (e.g. quaternary Ammonium salts and CHX)	1-2	To help in disinfection of viable organisms

1 scoop powder (7g) to 1/3 water (19ml)

Craig et al, 11th ed.,
Schillingburg, et al., 3rd ed.,

Which of the following properties accurately describe the polyether group of impression materials?

- Rapid set, low cost, hydrophilic
- Long working time, low stability, no custom tray needed
- Dimensional stability, accuracy, short setting time
- High tear strength, long setting time, unpleasant odor

Answer: C

Polyethers have excellent dimensional stability with accuracy even when poured seven days later. They set quickly relative to other materials, and have a high tear strength. They are hydrophilic, but stiff, requiring block-outs of all undercuts.

	Alginate	Condensation Silicones	Polysulfides	Polyethers	Addition Silicones
Examples	Irrev hydrocolloid	Elasticon, Citricon, Xanotopren	Permalastic, Omniflex	Impregum, Permadyne	Blue mousse Express, repositil
Advantages	- inexpensive - easy to use - hydrophilic - rapid set, adjusted by water temp - neutral taste - good tissue adaptation	- putty/wash eliminates need for custom tray - neutral taste and odor - economical	- economical - long working time 4-6 minutes - hi tear strength - good detail reproduction - combo of good flow and hi tear strength = choice for indirect cast post and cores	- hydrophilic - high tear strength - hi dimensional stability - short working and setting times	- Dimensional stability & accuracy - Excellent elastic recovery from deformation - Newer hydrophilic formulas improve wettability after set, improving pourability - Biocompatible
Disadvantages	- dimensional instability - difficult to	- poor dimensional stability	- "rotten egg" smell, unpleasant taste	- very rigid, difficult to remove from	- expensive - limited shelf life

disinfect without distortion – imbibition swelling - lack of detail reproduction when compared to other impress - single pour - cast must be removed from impress within one hour - not all are compatible with gypsum	- must pour immediately - limited shelf life - low tear strength - hydrophobic	- lead in some formulations - limited period of dimensional stability - stains clothes - high potential for distortion	undercuts - opaque material makes it difficult to detect pressure spots - distorts with humidity and moisture - avoid immersion disinfection Expensive - possible patient allergy to alkyl benzene sulfonate	- poor adhesion between putty and wash - hydrogen gas release in some brands - low tear strength of low viscosity materials
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*Air Force Review 1990; Craig et al 10th ed
 Craig RG. Restorative dental materials, ed 10. 1997: 310.*

You are making a final impression in a custom tray with a rubber impression material. Severe undercuts are present and accurate replication of these undercuts is essential. What is the best choice of material to use?

- Polysulfide
- Condensation silicone
- Addition silicone
- Polyether

Answer: C

Addition silicone is also known as polyvinylsiloxanes. When a rubber impression material is removed from the mouth, the material is deformed temporarily. The material recovers from this deformation is expressed as a percentage. The addition silicones demonstrate the best recovery i.e. the least permanent deformation, followed by the condensation silicones, the polyethers, and the polysulfides.

Craig RG. Restorative dental materials, ed 10. 1997: 310.

Tear strength is important because it indicates the ability of a material to withstand tearing in thin interproximal areas. Therefore selecting a low tear strength material like polysulfide, is a good idea for making impressions

- Both statements are TRUE
- Both statements are FALSE
- First is TRUE, the second is FALSE
- First is FALSE, and the second is TRUE

Answer: C

Tear strength is important because it indicates the ability of a material to withstand tearing in thin interproximal areas. However, a high tear strength material is more desirable and polysulfide has a high tear strength characteristic.

Wettability An impression material should have intimate contact with the tooth and underlying soft tissues and should not form bubbles or voids. Wettability is best with a hydrophilic material. Material should possess ability to displace moisture.

Flexibility Flexible impressions are easier to remove from the mouth when set.

Elastic Recovery A set impression must be sufficiently elastic so that it will return to its original dimensions without significant distortion upon removal from the mouth.

Tear Strength Adequate tear strength is important. Thin areas of material must resist tearing upon removal from the mouth and when separating the model and the impression.

Dimensional Stability Minimal dimensional changes that result during polymerization and prior to casting of the impression are desired. In addition silicones, these changes are small resulting in a dimensionally stable impression that is usable for weeks.

Detail Reproduction An impression material must reproduce even the finest of details and transfer these details accurately to gypsum, metal or polymer dies.

Craig et al, 11th ed

Dental Advisor December 2003, Vol 10 No 10

The set of PVS material impression can be inhibited by a number of chemical compounds, such as sulfur. Therefore, the use of vinyl gloves is contraindicated when working with PVS materials.

- a. Both statements are TRUE
- b. Both statements are FALSE
- c. First is TRUE, the second is FALSE
- d. First is FALSE, and the second is TRUE

Answer: C

The setting of PVS impression materials can be inhibited by a number of chemical compounds. Precautions need to be taken any time an impression will be made. Latex gloves contain a sulfur compound, *zinc diethyl dithiocarbamate*, which can completely inhibit polymerization of PVS in concentrations as low as 0.005%. This inhibition occurs even if gloves are washed before contact with PVS or tooth structure, and even if the surface is washed after contact with the gloves. Therefore, the use of **latex gloves** during crown-and-bridge procedures is **contraindicated**; **wear vinyl or nitrile gloves** when working with PVS materials.

Particulate sulfur and sulfur chloride compounds also inhibit polymerization of PVS materials. Residues from temporary crown materials, such as acrylics and methacrylates, and the use of petroleum jelly lubricants, such as Vaseline, may interfere with the setting reaction of PVS materials, lessening their ability to pick up fine details. If using a lubricant, apply a water-soluble jelly, such as K-Y Jelly, which can easily be washed off the preparation site.

Baumann MA. *The influence of dental gloves on the setting of impression materials.* *Br Dent J.* 1995;179:130-135.

Kahn RL, Donovan TE. *A pilot study of polymerization inhibition of poly (vinyl siloxane) materials by latex gloves.* *Int J Prosthodont.* 1989;2:128-130.

Kimoto K, Tanaka K, Toyoda M, et al. *Indirect latex glove contamination and its inhibitory effect on vinyl polysiloxane polymerization.* *J Prosthet Dent.* 2005; 93:433-438.

Indications for glass ionomer cements (choose all that apply):

- a. Crown margin repairs
- b. Class IV restorations
- c. Class III restorations
- d. Non-stress bearing areas
- e. Core build ups with less than 3 sound walls remaining
- f. Core buildups with more than 3 sound walls remaining

Answer: a, c, d, and f

In addition to the ones listed above, indications include: Class V in adults, Class I and II in primary, temporary or caries control restorations, crown margin repairs, cement base under amalgam, resin, ceramics, direct and indirect gold. Contraindications for glass ionomer cements would be placement in high stress areas: cusp replacement, Class IV and Class II, core build-ups with less than 3 walls.

Which of the following factors provides the greatest possibility for the etiology of Cracked Tooth Syndrome?

- a. Mandibular 2nd molar
- b. Mandibular 1st molar
- c. Tongue Ring
- d. Transillumination
- e. Tooth sleuth
- f. Large restorations (covering 2/3 of the surface)
- g. Bruxism

- 1. (a), (b), (c), (d), (e)
- 2. (a), (c), (f), (g)
- 3. (b), (c), (f), (g)
- 4. (b), (c), (d), (e)
- 5. All of the above
- 6. None of the above

Answer: 2

Pain on releasing is the hallmark sign.

Historically, CTS was associated with the placement of “soft gold” inlays (Class I Gold) that were physically adapted to the cavity using a mallet. Nowadays, common causes include masticatory accidents, such as biting on a hard, rigid object with unusually high force, or excessive removal of tooth structure during cavity preparation. Parafunctional habits such as bruxism are also associated with the development of this condition. The higher incidence of CTS in mandibular second molars may be associated with their proximity to the temporo-mandibular joint, based on the principle of the “lever” effect — the mechanical force on an object is increased at closer distances to the fulcrum. There are reports in the recent literature of the generation of such cracks associated with lingual barbells.

Transillumination, use of the tooth sleuth, evidence of wear facets, and dye staining with Methylene Blue are methods for diagnosing this condition. Radiographs generally are not a recommended method for diagnosing.

Stabilization along with occlusal adjustment can lead to immediate relief of the tooth. However, if this does not alleviate the discomfort, then root canal therapy will be necessary to restore the tooth.

Lynch et al., The Cracked Tooth Syndrome. J Can Dent Assoc 2002; 68(8):470-5

How many milligrams of fluoride are contained in an 8.2 ounce tube of toothpaste sold in the U.S Containing approximately 1100 ppm F⁻?

- A. 132 mg
- B. 232 mg
- C. 354 mg
- D. 408 mg

Answer is? **B**

Either sodium fluoride or sodium monofluorophosphate contains approximately **1.0** mg of fluoride per gram of toothpaste. To solve the question, convert ounces to grams: 1 tube = 8.2 oz. / 1 oz = 28.35 grams.

8.2 ounces X 28.35 = 232 grams

(approximately).

For an adult, the lethal dose of fluoride is between 2.5 and 10 g, with the average lethal dose being 4-5 g. Death has occurred in infants with as little as 0.25 g (250mg). Death is likely in a child who ingests more than 15 mgF/kg body weight (for example, 5 teaspoons of APF gel for a 44 lb child), so it is really weight dependent. Most fluoride is rapidly absorbed by the small intestine and stomach (an acid pH is required to facilitate this diffusion process). The currently accepted estimate for the minimum lethal dose of fluoride is 5 mgF/kg. This is called the Probable Toxic Dose (PTD). The PTD, 5.0 mgF/kg, is defined as the dose of ingested fluoride that should trigger immediate therapeutic intervention and hospitalization of the likelihood of serious toxic consequences. Stannous fluoride is not used in any currently approved dentifrice in the United States.

References:

Recommendations for Using Fluoride to Prevent and Control Dental Caries in the United States, US Department of Health and Human Services, Aug, 2001, Vol.60, pp 14-15.

Match the constituents of amalgam with the properties they contribute to the mix?

- | | |
|---------------|--|
| ___ Silver | A. activates reaction with other alloy particles to produce different phases |
| ___ Tin | B. decreases oxidation of the other elements |
| ___ Copper | C. decreases setting time, increases setting expansion and strength |
| ___ Mercury | D. reduces corrosion |
| ___ Zinc | E. decreases surface tension, reduces creep and marginal breakdown |
| ___ Palladium | F. increases setting time, decreases expansion and strength |
| ___ Indium | G. ties up tin reducing gamma-2 formation |

Answer is:

- | | |
|--------------------|--|
| C Silver | A. activates reaction with other alloy particles to produce different phases |
| F Tin | B. decreases oxidation of the other elements |
| G Copper | C. decreases setting time, increases setting expansion and strength |
| A Mercury | D. reduces corrosion |
| B Zinc | E. decreases surface tension, reduces creep and marginal breakdown |
| D Palladium | F. increases setting time, decreases expansion and strength |
| E Indium | G. ties up tin reducing gamma-2 formation |

Basic constituents:

Silver (Ag) 40-70%---decreases setting time, increases setting expansion and increases strength

Tin (Sn) 25-27%---decreases expansion and strength and increases setting time (influences amalgam in opposite manner to Silver.

Copper (Cu) 9-30%---ties up tin reducing gamma-2 formation, increases strength, reduces tarnish and corrosion, reduces creep.

Mercury (Hg) 3% max---activates reaction with other alloy particles to produce different phases.

Other Constituents:

Zinc (Zn) 1%---used in manufacturing, decreases oxidation of other elements.

Palladium (Pd) 1%---reduces corrosion

Indium (In) 1%---decreases surface tension, reduces creep and marginal breakdown and increases strength---
Must be used in admixed alloys.

References:

Martinez, MC, Rivera, JM, Rodriguez, Colon LI, & De Jesus NR, Applications of Engineering Mechanics in Medicine, University of Puerto Rico, Mayaguez. September, 2003, pp B2-5.

The major effect of Platinum on a gold casting alloy is?

- A. Corrosion resistance
- B. To increase the hardness
- C. To elevate the melting range
- D. To increase tensile strength
- E. To offset the color contributions of copper

- 1. A & C
- 2. B & D
- 3. C & E
- 4. B & C
- 5. C & D

Answer is: **5 (C & D)**

Gold ---Increases resistance to tarnish and corrosion, increases ductility and malleability.

Copper- Principal hardener; is necessary for heat treatment

Silver---Main purpose is to modify the red color produced by gold and copper; reduces melting temp; increases ductility and malleability.

Platinum-Raises melting temperature; increases tensile strength; decreases coefficient of thermal expansion; Reduces tarnish and corrosion.

Palladium-Raises melting temperature; increases hardness; acts to absorb hydrogen gas which can cause porosity in the casting; prevents tarnish and corrosion; has very strong whitening effect on gold alloys even when used at a low concentration.

Zinc-----Acts as a scavenger and prevents oxidation of the other metals during the manufacturing process; increases fluidity and decreases surface tension, which improves castability.

Iridium----Acts as a grain refiner; this increases tensile strength and percentage elongation; it also increases, to a lesser degree hardness and yield strength.

References:

Santulli, GA, Neitzke CM. NPDS Fixed Prosthodontics Syllabus 2007. pp 121-122.

Shillingburg HT, et al. Fundamentals of Fixed Prosthodontics. 3rd edition. Quintessence books. 1997 pp. 520-521

The outline form of a class V composite preparation resembles that of a class V amalgam preparation except for what important feature?

- A. No retentive grooves are necessary
- B. The internal line angles are much more rounded
- C. Pulp protection is not required
- D. All of the above

The answer is: **B**

When restoring teeth with composite resin, it is much easier to compress the material into rounded line angles. The outline form of a class V restoration is not always uniform, as it will vary depending on the location and amount of caries or decalcification, the size and location of the carious lesion determines the outline form of the cavity preparation. When the carious tissue has been removed and the margins are on reliable enamel or dentin, the outline will usually be rectangular with the corners round, ovoid or kidney-shaped, very much resembling the amalgam class V preparation except that the internal line angles are much more rounded. Retentive grooves supplement the etched enamel retention (these grooves are placed in both incisal and gingival axial line angles). Pulpal protection would be used in either preparations when restoration will be in close proximity to the pulp.

References:

Summitt JB, Robbins JW, Schwartz RS. Fundamentals of Operative Dentistry a contemporary approach. 2nd Edition, Quintessence Publishing CO, Inc, 2001. pp 394-396.

Which of the following are advantages of the visible light curing systems compared to the old ultraviolet light curing systems?

- A. A greater depth of resin can be cured by visible light

- B. The resin can be polymerized through enamel, which is particularly advantageous in class III restorations.
- C. Generally the intensity of visible lights remains relatively constant until the bulb fails completely.
- D. All of the above

Visible light curing systems have virtually replaced the UV light systems. Also, visible light curing systems are much more widely used than the chemically activated ones (self cured). An advantage of light curing systems as a whole is that the dentist has complete control over the working time and is not confined to the built-in curing cycle of the self-cure. This is particularly beneficial when large restorations are placed.

To deal with problems of incomplete curing with VLC due to the thickness of restorations and filler particles scattering light, manufacturers have developed composite resins that are dual cured which combines self curing and visible light-curing. Another polymerization method is staged curing which is a two-staged cure. However, VLC composites are still the most popular today.

Visible light cured composites are single component pastes, and the polymerization process is activated by an external energy source. The alpha-diketone initiator (usually camphor quinone) absorbs energy from a visible (474 nm-blue light) light source. The ketone absorbs energy and reacts with an amine (added to the system to enhance the effect of the light-sensitive catalyst) to produce free radicals.

Answer is: **D**

References:

Summitt JB, Robbins JW, Schwartz RS. Fundamentals of Operative Dentistry a contemporary approach. 2nd Edition, Quintessence Publishing CO, Inc, 2001. pp 254-255.
An introduction to Loctite Ultraviolet Light Curing Technology, Loctite Corp. 1999,pp 2-14.

True or False

Cavity configuration (C) factor is the ratio of the bonded surface area in cavity prep to the unbonded surface area.

In a box-like class I cavity preparation, there is four times more bonded surface area than the unbonded surface area.

- A. First sentence is true and second sentence is false
 - B. First sentence is false and second sentence is true
 - C. Both sentences are true
 - D. Both sentences are false
-

Answer is: **A**

Cavity configuration factor, or C-factor, is the ratio of bonded versus unbonded surfaces in a cavity preparation. Whereby the higher the # of bonded surfaces the higher the C-factor.

$$\text{C-Factor} = \frac{\text{total bonded surfaces (mm}^2\text{)}}{\text{Unbonded area (mm}^2\text{)}}$$

An occlusal preparation has 5 surfaces (mesial, distal, buccal, lingual and pulpal) so it has 5 times more bonded Surface area than unbonded surface area.

References:

Franklin R. Tay, et al. Geometric Factors Affecting Dentin Bonding in Root Canals: A Theroretical Modeling Approach. JOE, Volume 31, #8, 2005, pp 584-589.

Summitt JB, Robbins JW, Schwartz RS. Fundamentals of Operative Dentistry a contemporary approach. 2nd Edition, Quintessence Publishing CO, Inc, 2001. pp 186-187.

Roberson, Theodore; Harold Haymann & Edward Swift (2002), Sturdevant's Art and science of Operative Dentistry, St. Louis, Missouri: Mosby pp 197-201.

Drawbacks attributed to the use of calcium hydroxide as a pulp capping agent include which of the following:

1. Dissolution with acid etching
 2. Degradation under leaky restorations
 3. Interfacial failure during amalgam condensation
 4. Long term success steadily drops to less than 10% after 10 years
-
- a. 1 and 3
 - b. 2 and 4
 - c. 1,2 and 3
 - d. 1,2,3 and 4
 - e. 4 only

Answer: C. 1,2 and 3. The most significant drawback of calcium hydroxide is that acids cause dissolution, the material degrades under restorations and it does not provide a strong base for restorations. However, clinical trials demonstrate favorable long term success when used as a pulp capping material. Therefore, the use of Ca(OH)₂ should be limited to as small an area as possible. Light-activated forms have been developed which eliminates most of the problems, and a glass ionomer lining material can be placed over the Ca(OH)₂ as well. The glass ionomer then provides acid resistance and the ability to support condensation pressures. Finally, the advantages of fluoride release and adhesion to tooth structure help the long term prognosis of the Ca(OH)₂ / glass ionomer combination.

Summitt et al, Fundamentals of Operative Dentistry, a contemporary approach, Quintessence books 2nd ed., Copyright 2001, Prague, pp 106-107.

Which of the following oral conditions may preclude the use of the rubber dam?

1. Teeth that have not erupted fully
 2. Asthma
 3. Psychologic reasons
 4. Latex allergy
-
- a. 1 and 3
 - b. 2 and 4
 - c. 1,2 and 3
 - d. 4 only
 - e. All of the above

Answer: e. All of the above. A tooth that has not erupted fully may not support a retainer. Asthma may, in extreme cases, prevent the patient from tolerating a rubber dam as well as Psychologic reasons. A patient with latex allergies should not have a rubber dam; however, non-latex materials are now available, and a non-latex glove can be cut to create a make-shift rubber dam if needed...

Sturdevant's Art and Science of Operative Dentistry, 4th ed. P. 446 Mosby, 2002

Tetracycline staining always occurs at a young age. Long term bleaching effects from peroxide solutions take effect by decreasing the translucency of the enamel, preventing the effects of dentinal stain from shining through the enamel.

- a. Both statements are true.
- b. The first statement is true, the second is false.
- c. The first statement is false, the second is true.
- d. Both statements are false

Answer: d. Both statements are false. Tetracycline staining most frequently occurs at an early age. It is caused by ingestion of the drug concomitant with development of the dentition, "However, studies indicate that permanent teeth in adults also can experience a graying discoloration as a result of long-term exposure to minocycline, a tetracycline analog." Sturdevant's Art and Science of Operative Dentistry, 4th ed. p. 606 Mosby, 2002. The mechanism of action of bleaching teeth with peroxide is considered to be oxidation of organic pigments.

Sturdevant's Art and Science of Operative Dentistry, 4th ed. P. 606-8 Mosby, 2002

In treating caries, the medical model of management primarily involves caries management directed at the tooth level by surgical treatment. A secondary focus is eliminating the causative factors for caries.

- a. Both statements are true.
- b. The first statement is true, the second is false.
- c. The first statement is false, the second is true.
- d. Both statements are false.

Answer: D. Both statements are false. The medical model of management identifies and eliminates the causative factors for caries as the primary focus in addition to the restorative repair of damage caused by caries. Cariogenic plaque formation on the tooth causes demineralization of the tooth. Caries is an infectious disease. A patient is at high risk for the development of new cavitated lesions if:

1. High Mutans streptococci counts are found or
2. Any 2 of the following exist:
 - 2 or more active lesions
 - Large number of restorations
 - Poor dietary habits
 - Low salivary flow

The following tests help identify caries activity:

- Identification of subsurface demineralization
- Bacterial testing
- Assessment of environmental conditions (pH, salivary flow, salivary buffering)

However, no single test is 100% predictive of later development of cavitated lesions, so the concept of caries risk is used to identify patients at high risk and therefore to take preventative action.

Sturdevant's Art and Science of Operative Dentistry, 4th ed. P. 64-115 Mosby, 2002

Which one(s) of the following are beneficial effects of xylitol gum?

1. Decrease in plaque accumulation
 2. Decrease in Mutans Streptococci in dental plaque
 3. Increase of plaque pH
 4. Stimulation of salivary flow
 5. Interferes with glucose metabolism by Mutans Streptococci
- a. 1 and 3
 - b. 2 and 4
 - c. 1,2 and 3
 - d. 2,3,4 and 5
 - e. All of the above

ANSWER:

e. All of the above

Xylitol is a 5-carbon ring sugar found in nature (bananas, among other things). It is a normal intermediate in human metabolism, but in Mutans streptococci it causes energy depletion and inhibits glycolysis and ATP synthesis. Studies in Finland involving total substitution of Xylitol for sucrose and xylitol chewing gum studies show up to 85% reduction in dental caries. Use of chewing gum stimulates salivary flow and increases mechanical removal of plaque. Recommendations for caries risk patients call for daily dose of 5-10 gms of xylitol. This is accomplished by 5 sticks of gum or 5-10 pellets. Chewing time is 5 minutes (until flavor is gone). Patients should chew after meals, for snacks and before bed.

Nordin and Cook, Operative/Preventive Dentistry Lecture, July 2006

Which of the following statements is/are true about the soft start polymerization technique?

- 1. Less polymerization stress is associated with the use of this technique.**
 - 2. It works with all types and brands of curing lights.**
 - 3. Can involve use of stepped, ramped or pulse delayed light curing methods.**
 - 4. A stepped cure involves increasing the intensity every 10 seconds for one minute.**
- A. 1, 3**
- B. 1, 2, 3**
- C. 3 only**
- D. 1, 2, 3, 4**

Answer: A

Soft start polymerization involves a slow increase or delay in irradiance. A slower rate of shrinkage and reduction in stress are the desired advantages. Some curing lights have a soft start curing program build into them. There are three methods for soft start polymerization:

Stepped - Short, low initial burst for 10 seconds, then full intensity for the remainder of the curing time.

Ramped – Gradual increase from an initial low level.

Pulse delayed – Short, low level burst. Delay for polishing. Full intensity.

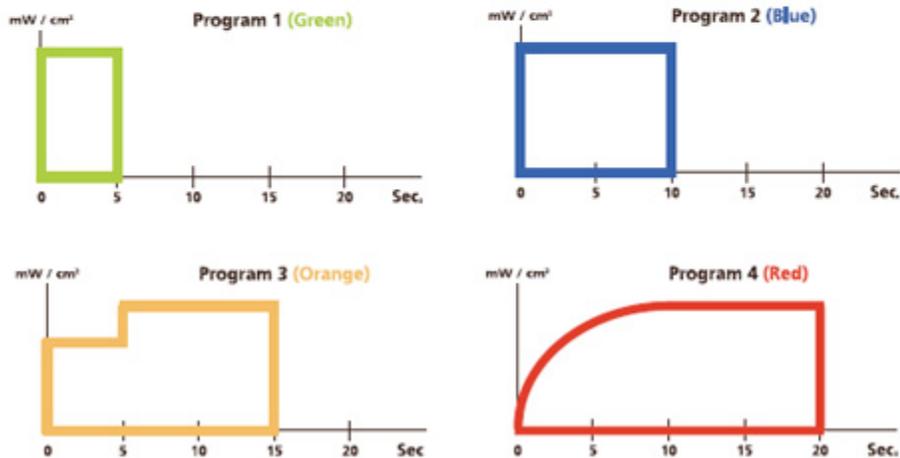
Lab studies are equivocal as far as marginal adaptation and gap formation. Studies have shown reduced polymerization stress when a soft-start method is used.

Green : Maximum light output for 5 seconds

Blue : Maximum light output for 10 seconds

Orange : An initial 70% output of maximum light intensity for 5 seconds, followed by 10 seconds output at full power (Two-Step curing program)

Red : An initial 10% output of maximum light intensity that gradually increases to full power in 10 seconds, followed by 10 seconds output at full power (Soft-Start curing program)



References:

Fundamentals of Operative Dentistry. 3rd Edition. 2006. Summitt, Robbins, Hilton and Schwartz. Pg. 198.

Amaral CM, Peris AR, Ambrosano GM, Pimenta LA. Microleakage and gap formation of resin composite restorations polymerized with different techniques. Am J Dent. 2004

Jun; 17(3):156-60. "No statistical difference among polymerization techniques was observed for microleakage (Kruskal-Wallis test). For gap formation there was no statistical difference among polymerization techniques either before or after thermocycling (Tukey test). Conversely, thermocycling significantly increased the gap formation for all groups. No correlation (Spearman correlation test) was observed for the results of microleakage and gap formation."

Sahafi A, Peutzfeldt A, Asmussen E. Soft-start polymerization and marginal gap formation in vitro. *Am J Dent.* 2001 Jun; 14(3):145-7. "The soft-start polymerization procedures studied did not improve the marginal adaptation of two resin composites bonded to dentin cavities compared with conventional polymerization."

http://www.diadent.co.kr/upload_img/qlite_story.jpg

Bouschlicher MR, Rueggeberg FA. Effect of ramped light intensity on polymerization force and conversion in a photoactivated composite. *J Esthet Dent* 2000;12:328-339. "The slower conversion rate resulting from ramped light intensity helped to reduce the rate and maximum polymerization stress."

Mehl A, Hickel R, Kunzelmann KH. Physical properties and gap formation of light-cured composites with and without "softstart-polymerization". *J Dent* 1997;25:321-330. "...initial cure with low light intensity followed by final cure with high light intensity significantly improves the marginal integrity of light-cured composite fillings and also the material properties. "

Yoshikawa T, Burrow MF, Tagami J. A light curing method for improving marginal sealing and cavity wall adaptation of resin composite restorations. *Dent Mater* 2001;17:359-366. "The use of a low initial light intensity (270mW/cm²) for 10s followed by high intensity light (600mW/cm²) for 50s provides the best adaptation of resin composite to cavity walls and possibly the least polymerization contraction stress."

Friedl KH, Schmalz G, Hiller KA, Markl A. Marginal adaptation of Class V restorations with and without "softstart-polymerization". *Oper Dent* 2000;25:26-32. "...softstart polymerization using a very low starting intensity did not improve the marginal adaptation of polyacid-modified resins or composite resins in Class V cavity preparations."

Hasegawa T, Itoh K, Yukitani W, Wakumoto S, Hisamitsu H. Effects of soft-start irradiation on the depth of cure and marginal adaptation of dentin. *Oper Dent* 2001;26:389-395. "Marginal gap formation of Clearfil APX, Estelite and Silux Plus with the experimental bonding system was completely prevented regardless of the kind of irradiation methods used. The deterioration of marginal adaptation caused by the Megabond system could not be improved by use of the soft-start method programmed in Elipar Highlight."

Muangmingsuk A, Senawongse P, Yudhasaraprasithi S. Influence of different

softstart polymerization techniques on marginal adaptation of Class V restorations. Am J Dent 2003;16:117-119. "There was no statistically significant difference of dye penetration among techniques at enamel or dentin margins ($P > 0.05$). Dye penetration observed at dentin margins was significantly higher than that observed at enamel margins ($P < 0.05$) except for the group restored with a combination of incremental technique and softstart-polymerization using Spectrum curing unit."

Hofmann N, Siebrecht C, Hugo B, Klaiber B. Influence of curing methods and materials on the marginal seal of Class V composite restorations *in vitro*. Oper Dent 2003;28:160-7. "Few differences were observed between the light curing protocols. However, less leakage was observed in the case of the lower shrinking RBC Filtek Z250."

Which of the following statements is/are true of the DIAGNOdent instrument?

- a. It works well with all size carious lesions.**
- b. It is a laser-based instrument that measures fluorescent photons.**
- c. Readings between 0 and 20 indicate healthy tooth structure.**
- d. It has an accuracy of over 90%.**

1. b, d

2. a, b

3. a, b, c

4. All of the above

Answer: 1

The DIAGNOdent is a laser-based instrument developed by KaVo to serve as an adjunct to visual inspection and radiographic exam. The tip emits light and gathers fluorescent photons. The intensity of the gathered light depends on bacterial porphyrins within the lesion and appears to indicate size and depth of the lesion. It is more reliable with larger lesions. It can be confused by staining and calculus and interpret them as demineralized tooth structure. It works better for pit and fissure caries than it does for proximal caries. A baseline reading must be set using healthy tooth structure before beginning measurements of potential carious areas. It has been shown to be over 90% accurate. The following is a listing of what specific values obtained represent:

(0-10) Healthy normal tooth structure.

(11-20) Outer half enamel caries.

(21-30) Inner half enamel caries.

(30+) Dentinal caries.

Values between 11 and 30 represent early caries activity and these lesion need to be watched and use of fluoride supplements is recommended.

Values greater than 30 need to be restored.

References:

Fundamentals of Operative Dentistry. 3rd Edition. 2006. Summitt, Robbins, Hilton, Schwartz. Pg. 88.

Clinical tutorial on KaVo web-site: www.kavousa.com

Match the following components with their function in the setting reaction of composite restorations. One answer per component.

- | | | |
|------------------------------------|-------|--|
| a. Organosilane | _____ | Lowers viscosity, ↑ polymer conversion, cross-linking and shrinkage. |
| b. Benzophenone | _____ | Increases strength and abrasion resistance. |
| c. TEGDMA | _____ | UV absorber. |
| d. Glass | _____ | Serves as an inhibitor to the setting reaction. |
| e. Metal oxides | _____ | Initiator of the reaction by absorbing blue light at 400-500nm. |
| f. Camphorquinone | _____ | Bifunctional molecule that combines filler particles with the resin matrix. |
| g. butylated hydroxytoluene | _____ | Provides shading and opacity. |

Answer:

a. Organosilane	<u>c</u> Lowers viscosity, ↑ polymer conversion, crosslinking and shrinkage.
b. Benzophenone	
c. TEGDMA	<u>d</u> Increases strength and abrasion resistance.
d. Glass	<u>b</u> UV absorber.
e. Metal oxides	<u>g</u> Serves as an inhibitor to the setting reaction.
f. Camphorquinone	<u>f</u> Initiator of the reaction by absorbing blue light at 400-500nm.
g. butylated hydroxytoluene	<u>a</u> Bifunctional molecule that combines filler particles with the resin matrix.
	<u>e</u> Provides shading and opacity.

The setting reaction for resin restorative composites involves free radical polymerization. The following stages occur during the setting reaction:

Initiation – Production of reactive free radicals. This is accomplished with a peroxide-amine system and exposure to blue visible light or a diketone-amine system.

(Benzoyl peroxide + Aromatic tertiary amine + blue visible light) → free radicals

or (A diketone such as camphorquinone + Aliphatic amine + blue visible light) → free radicals

Propagation – Molecules link together forming chains and cross-linking begins.

Termination – Material stiffens. Not all double bonds react. The "degree of conversion" varies from 35% at the air inhibited layer to 80% in the bulk.

Inhibition – Inhibitors terminate the reaction.

Composites are composed of the following components:

Resin matrix monomer – Bis-GMA which is an oligomer and is very viscous. Diluents are added to lower the viscosity and increase polymer

conversion, crosslinking and shrinkage. Diluents may be UDMA, EGDMA or TEGDMA. Shrinkage is about 2-7%.

initiator - Camphorquinone. Absorbs blue light at 400-500nm.

activator - Tertiary amine.

inhibitor - Heat, light, butylated hydroxytoluene, atmospheric oxygen, p-hydroquinone.

pigments - Metal oxides. Titanium and aluminum oxide. Provide shading and opacity.

Inorganic filler - Glass, quartz, colloidal silica. Increase mechanical properties including strength, abrasion resistance, esthetics and handling.

Coupling agent - Organosilane. Combines filler particles with resin matrix. It is a bifunctional molecule.

UV absorbers – Benzophenone.

References:

Restorative Dental Materials. 11th Edition. 2002. Craig and Powers. Pg: 188, 190-191.

What is the proper sequence of events that occur during the setting reaction of glass ionomer cements?

- a. **Release of Ca^{++} , Al^{+++} , F^- ions and silica-based hydrogel forms around glass particles.**
- b. **The polycarboxylates ionically crosslink the poly anion chain and cause the cement to harden.**
- c. **Powder and liquid are mixed together.**
- d. **A slow hydration of both the silica-based hydrogel and the polycarboxylates occurs which results in a further improvement in the cement's physical properties.**
- e. **H^+ ions are released from ionization of polyacrylic acid in water. H^+ ions attack the glass particle.**
- f. **Ca^{++} and Al^{+++} ions migrate from the silica hydrogel into the aqueous cement**

phase where, as the pH increases, they precipitate out as polysalts (polycarboxylates).

- 1. c, a, e, f, d, b**
- 2. c, e, a, f, b, d**
- 3. c, a, f, e, d, b**
- 4. c, e, a, f, d, b**

Answer: 2

It is an acid-base reaction between the glass powder and the polyacid liquid. When the powder and liquid are mixed, the fluoroaluminosilicate glass is attacked by hydrogen ions (H^+) from the polyalkenoic acid, releasing Al^{+++} , Ca^{++} , Na^+ and Fl^- ions. A layer of silica gel is slowly formed on the surface of unreacted powder, with the progressive loss of metallic ions. When the free calcium and aluminum ions reach saturation in the silica gel, they diffuse into the liquid and crosslink with two or three ionized carboxyl groups (COO^-) of the polyacid to form a gel. As the crosslinking increases through aluminum ions and the gel is sufficiently hydrated, the crosslinked polyacrylate salt begins to precipitate until the cement is hard.

The powder is ion-leachable calcium aluminofluorosilicate glass. Modern powders are composed of silica dioxide (41.9%), aluminum oxide (28.6%), calcium fluoride (15.7%), and possibly aluminum phosphate (12%), aluminum fluoride (8%) and sodium fluoride (9%).

The liquid is an aqueous solution of polymers and copolymers of acrylic acid (polyacrylic acid). In addition itaconic acid is present and promotes reactivity between the glass and the liquid. It also prevents gelation of the liquid which can result from hydrogen bonding between two polyacrylic acid chains. Polymaleic acid may also be present. It causes the cement to harden and lose its moisture sensitivity faster. Because polymaleic acid contains more carboxyl groups it leads to more rapid polycarboxylate crosslinking. Tartaric acid is a reaction-controlling additive. It extends working time and promotes a snap set by facilitating ion extraction from the glass particles. It then complexes with the ions, preventing them from cross-linking the polymer chain until the chain becomes more linear when crosslinking can occur more readily. Tartaric acid also strengthens and hardens the cement and improves the manipulative characteristics of glass ionomer cements.

Setting reaction is as follows:

Phase 1

1. Powder and liquid is mixed together.
2. Hydrogen ions (H⁺) are released from ionization of polyacrylic acid in water.
3. Hydrogen ions (H⁺) attack the glass particle.
4. Ca⁺⁺, Al⁺⁺⁺ and F⁻ ions are released and silica-based hydrogel forms around glass particles.

Phase 2

5. Ca⁺⁺ and Al⁺⁺⁺ ions migrate from the silica hydrogel into the aqueous cement phase where, as the pH increases, they precipitate out as polysalts (specifically as polycarboxylates).
6. The polycarboxylates ionically crosslink the poly anion chain and cause the cement to harden. Calcium polycarboxylates form first. They form over the first 5 minutes, while the stronger aluminum polycarboxylates form over the next 24 hours.

Phase 3

7. A slow hydration of both the silica-based hydrogel and the polycarboxylates occurs which results in a further improvement in the cement's physical properties. This phase may continue for several months.

Two important clinical results of this reaction are that the physical properties of the glass-ionomer cements take a relatively long time to fully develop because of the cement's long setting reaction and that the cement is sensitive to moisture contamination and to desiccation because the glass particles are covered with the hydrogel.

Reaction broken down into stages:

- i) Decomposition: Acid attacks gel particles releasing metal ions.
- ii) Migration: Ions migrate into aqueous cement matrix. Cement has a shiny, glossy appearance.
- iii) Gelation: Metal ions gel the polyacid. Calcium polyacrylate is the primary component. Cement is rigid and relatively opaque.
- iv) Post-set hardening: Ions become bound to the polyacid chain (crosslinking). Aluminum polyacrylate becomes the dominant component.
- v) Maturation: Increased crosslinking, decrease in "loosely" bound water, increase in "tightly" bound water. Leads to improved physical properties, increased

resistance to acid attack and desiccation and increased translucency. This can continue for several months.

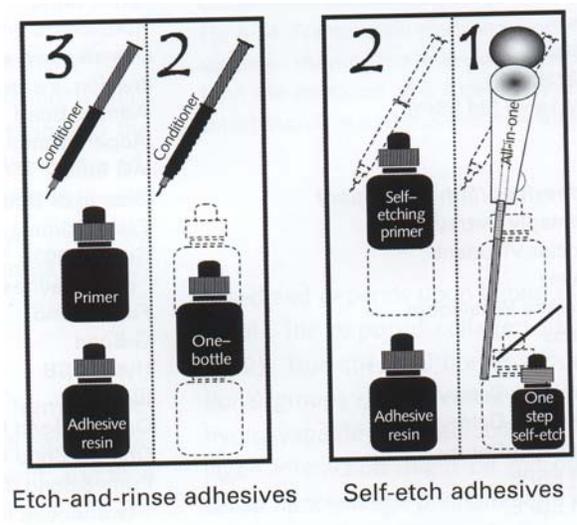
References:

Fundamentals of Operative Dentistry. 3rd Edition. 2006. Summitt, Robbins, Hilton, Schwartz. Pg. 245-246.

The total etch technique generally yields higher bond strengths than the self-etch technique. Clearfil SE Bond is an example of a total etch adhesive system.

- a. Both statements are true.
- b. The first statement is true. The second statement is false.
- c. The first statement is false. The second statement is true.
- d. Both statements are false.

Answer: b



Adhesives can be broken down into three groups: Etch and rinse (total etch), self-etch and glass ionomer adhesives. The etch-and-rinse approach involves three steps: Application of conditioner or acid etchant, followed by primer or adhesion-promoting agent and then the actual bonding agent or adhesive resin. The simplified two-step version combines the second and third step but still follows a separate etch-and-rinse phase. This technique is still the most effective approach to achieve an efficient and stable bond to enamel. Selective dissolution of hydroxyapatite crystals through acid

etching with 30 or 40% phosphoric acid gel is followed by polymerization of the resin that is absorbed by capillary attraction within the created etch pits, enveloping individually exposed hydroxyapatite crystals. In dentin, this phosphoric acid treatment exposes a microporous network of collagen with elimination of most or all hydroxyapatite. The bonding mechanism of etch-and-rinse adhesives to dentin is primarily diffusion-based and depends upon hybridization or infiltration of resin within the exposed collagen fibril scaffold. True chemical bonding is unlikely. The most critical step in the etch-and-rinse approach is application of the primer. If an acetone-based primer is used the wet-bonding technique is necessary. For water- or ethanol-based adhesives gentle air-drying of acid-etched dentin (and enamel) followed by dry-bonding is used. With the two-step etch-and-rinse adhesives, the primer and adhesive resin are combined into one solution. In the conventional three-step systems, the primer ensures efficient wetting of the exposed collagen fibrils, displaces residual surface moisture, transforms a hydrophobic tissue state into a hydrophilic one and carries monomers into the interfibrillar channels. The adhesive resin fills the pores between the collagen fibrils, forms resin tags that seal the opened dentinal tubules, initiates and advances the polymerization reaction, stabilizes the hybrid layer and resin tags and provides sufficient methacrylate double bonds for copolymerization with the restorative resin.

The self-etch approach is more user friendly and less technique sensitive. They do not require a separate etch-and-rinse step. This technique involves two- or one-step application procedures. These adhesives can be divided into strong, intermediary strong and mild self-etch adhesives. Low-pH self-etch adhesives have often been shown to have low bond strengths, especially to dentin. Mild self-etching agents leave residual hydroxyapatite still attached to the collagen. Sufficient surface porosity is created to obtain micromechanical interlocking. The preservation of hydroxyapatite within the submicron hybrid layer may serve as a receptor for additional chemical bonding. The weakest property of mild self-etch agents is their bond to enamel. Intermediary-strong adhesives typically produce a dentinal hybrid layer with a complete demineralized top layer and a partially demineralized base. The deepest region of the hybrid layer still contains hydroxyapatite. Better micromechanical interlocking is achieved in enamel as well as dentin. The residual hydroxyapatite at the hybrid layer base may still allow chemical intermolecular interaction. The strong self-etch adhesives work similarly to etch-and-rinse adhesives. They have been shown to have low bond strength values, especially to dentin. The one-step self-etch adhesives are user-friendly but they have lower bond strength values than multistep self-etch adhesives and etch-and-rinse adhesives.

Adhesives we use today:

4th generation adhesives – Pretreatment of dentin with conditioners and/or primers. They generally come with 30 to 40% phosphoric acid gels and are referred to as three-step etch-and-rinse adhesives. The final step involves the application of an unfilled or semifilled low-viscosity adhesive resin that copolymerizes with the primed dentin surface layer and simultaneously offers bonding receptors for copolymerization with the composite. Ex. All-bond 2, Optibond FL, Permaquik and Scotchbond Multi-Purpose.

5th generation adhesives – These adhesives utilize a separate etch-and-rinse (total-etch) phase followed by a combined primer-adhesive resin solution. Bond strengths are often a little less than 4th generation adhesives. Ex. Prime & Bond, Single Bond or Scotchbond 1.

6th generation adhesives – Self-etch adhesives. Omit the separate conditioning phase and are composed of two different solutions. These include adhesives with self-etching primers and those that combine the conditioner, primer and adhesive but require mixing. This generation contains two-step self-etch adhesives and one-step, two-step component self-etch adhesives. These adhesives use the smear layer on the enamel and dentin as a bonding substrate. Again bond strengths are generally lower than that of 4th and 5th generation adhesives. Ex. (two-step self-etch adhesives) AdheSE, Clearfil SE Bond, Clearfil Protect Bond, Optibond Solo plus Self-Etch and Tyrian SPE One-Step Plus. (One-step, two-component self-etch adhesives) Adper Prompt L-Pop, One-Up Bond F and Xeno III.

7th generation adhesives – Single component one-step self-etch adhesives. Truly one-bottle systems. Conditioner, primer and adhesive all in one bottle pre-mixed. Prone to phase separation and formation of droplets within their adhesive layers. Consistently lower bond strengths than 4th and 5th generation adhesives. Ex. Clearfil S³ Bond, G-Bond, i-Bond and Xeno IV.

Etch-and-Rinse Adhesives

Three-step etch-and-rinse adhesives

Advantages

- Separate application of conditioner, primer, and adhesive resin
- Low technique sensitivity
- Proven effectiveness of adhesion to enamel and dentin in vitro and in vivo
- Most effective and consistent results
- Best long-term results
- Possibility for particle-filled adhesive ("shock absorber")

Disadvantages

- Risk of overetching dentin (highly concentrated phosphoric-acid etchants), resulting in incomplete resin infiltration
- Time-consuming three-step application procedure
- Postconditioning rinsing required (risk of surface contamination)
- Sensitive to overwet or overdry dentin surface conditions (collagen collapse)
- Weak resin-collagen interaction (which may lead to nanoleakage and early bond degradation)
- Elaborate application procedure

Two-step etch-and-rinse ("one-bottle") adhesives

Advantages

- Basic features of three-step systems
- Simpler application procedure
- Possibility for single-dose packaging
- Consistent and stable composition
- Controlled solvent evaporation (when provided in single-dose packaging)
- Hygienic application (to prevent cross contamination)
- Possibility for particle-filled adhesive ("shock absorber")

Disadvantages

- Application procedure not substantially faster (multiple layers)
 - More technique sensitive (multiple layers)
 - Risk of a bonding layer that is too thin (no glossy film, no stress-relieving "shock absorber," insufficiently polymerizable due to oxygen inhibition)
 - Effects of etch-and-rinse technique
 - Risk of overetching
 - Postconditioning rinse phase required
 - Sensitive to dentin wetness
 - Weak resin-collagen interaction
 - Collagen collapse
 - Lower bonding effectiveness than for three-step etch-and-rinse adhesives in long-term studies
-

Self-Etch Adhesives (continued)

One-Step Self-Etch Adhesives

Advantages

- Most time-efficient application procedure
- No etching, postconditioning rinsing, or drying (which may be difficult to standardize)
- Simultaneous demineralization and resin infiltration
- Less sensitivity to diverse dentin-wetness conditions
- Possibility for single-dose packaging
- Consistent and stable composition
- Hygienic application (unidose, to prevent cross contamination)
- Possibility for particle-filled adhesive ("shock absorber")
- Possibility that phase separation in combination with strong air-blow may help to remove majority of water in adhesive

Disadvantages

- Complex mixes of hydrophobic and hydrophilic components, together with water and high concentrations of solvents

- Prone to phase separation and entrapment of droplets in adhesive layer (when not containing sufficient HEMA)
 - More technique-sensitive
 - No long-term clinical evaluation
 - Less sealing capacity; acts as a semipermeable membrane
 - Most self-etch systems contain water
 - Water influences polymerization adversely
 - Reduced shelf life (hydrolysis of monomers)
 - High hydrophilicity (due to acidic monomers)
 - Promotes water sorption
 - Impaired durability
 - Incompatibility with autocuring composites
 - Insufficient long-term clinical research
 - Conflicting results in literature concerning bonding effectiveness to enamel for mild self-etch adhesives
 - Bonding effectiveness very dependent on composition of adhesive solution
-

Mild vs Strong Self-Etch Adhesives

Mild Self-Etch Adhesives (pH \approx 2)

Advantages

- Hydroxyapatite crystals available within the hybrid layer (chemical interaction potential)
- Relatively good in vitro and in vivo bonding effectiveness

Disadvantages

- Insufficient bonding effectiveness to enamel (although improving)

Strong Self-Etch Adhesives (pH \approx 1)

Advantages

- Good enamel bonding

Disadvantages

- No hydroxyapatite left throughout hybrid layer
- Reduced shelf life
- More hydrophilic
- Generally lower dentin bond strengths
- Incompatibility with autocuring composites

Self-Etch Adhesives

Two-step self-etch adhesives

Advantages

- No etching, postconditioning rinsing, or drying (which may be difficult to standardize)
- Time-saving application procedure
- Simultaneous demineralization and resin infiltration
- Less sensitivity to diverse dentin-wetness conditions
- Possibility for single-dose packaging
- Consistent and stable composition
- Controlled solvent evaporation (when provided in single-dose packaging)
- Hygienic application (unidose, to prevent cross contamination)
- Possibility for particle-filled adhesive ("shock absorber")
- Effective dentin desensitizer
- Separate adhesive resin (as compared to one-step adhesives)
- Better mechanical strength
- No complex mixtures of hydrophobic and hydrophilic components
- Good performance in vitro and in vivo, approaching bonding effectiveness of etch-and-rinse adhesives, in particular "mild" two-step self-etch adhesives

- Reported reduced postoperative sensitivity
- Excellent 3-year clinical performance for mild two-step self-etch adhesives

Disadvantages

- More elaborate application procedure than one-step solutions
 - Incompatibility with autocuring composites (in particular low-pH self-etch adhesives)
 - More long-term clinical research required
 - Most self-etch systems contain water
 - Water influences polymerization adversely
 - Reduced shelf life (hydrolysis of monomers)
 - Conflicting results in literature concerning bonding effectiveness to enamel, in particular for mild self-etch adhesives
 - Bonding effectiveness very dependent on composition of adhesive solution
 - High hydrophilicity (due to acidic monomers)
 - Promotes water sorption
 - Impaired durability
-

Table 8-2 Contemporary adhesives categorized according to adhesion strategy and clinical application steps and chronological classification

Brand name	Manufacturer	Brand name	Manufacturer
Etch-and-rinse adhesives		<i>Two-step self-etch adhesives (sixth generation) (continued)</i>	
<i>Three-step etch-and-rinse adhesives (fourth generation)</i>		Scotchbond 2	3M ESPE (selective enamel etching)
All-Bond 2	Bisco	Solobond Plus	Voco
Clearfil Liner Bond	Kuraray	Syntac (Classic)	Ivoclar Vivadent (selective enamel etching)
Denthesive	Heraeus Kulzer	Tokuso Mac Bond II	MAC
EBS	ESPE (now 3M ESPE)	Tyrean	Bisco
Gluma CPS	Bayer Leverkusen (now Heraeus Kulzer)	Unifil Bond	GC
OptiBond DC	Kerr		
OptiBond FL	Kerr		
Permagen	Ultradent	<i>One-step self-etch adhesives (sixth and seventh generation; division is ambiguous and depends on time of market launch)</i>	
Permaquik	Ultradent	Admira Bond	Voco
Scotchbond MultiPurpose	3M (now 3M ESPE)	Adper Prompt L-Pop	3M ESPE
		AQ Bond	Sun Medical
<i>Two-step etch-and-rinse adhesives (fifth generation)</i>		Clearfil S ³ Bond	Kuraray
C36 Prime&Bond NT	Dentsply-Detrey	Etch&Prime 3.0	Degussa AG
Excite	Ivoclar Vivadent	Sustel/F2000	3M ESPE primer-adhesive
Gluma 2000	Bayer	Futurabond	Voco
One Coat Bond	Coltène Whaledent	G-Bond	GC
One-Step	Bisco	Hytac OSB	ESPE (now 3M ESPE)
OptiBond Solo Plus	Kerr	iBond	Heraeus Kulzer
Prime&Bond 2.0	Dentsply-Detrey	One-Up Bond F	Tokuyama
Prime&Bond 2.1	Dentsply-Detrey	One-Up Bond F Plus	Tokuyama
Prime&Bond NT	Dentsply-Detrey	Prime&Bond 2.1 (without etching)	Dentsply-Detrey
Scotchbond 1XT	3M ESPE	Prime&Bond NT (without etching)	Dentsply-Detrey
Single Bond (Scotchbond 1)	3M ESPE	Prompt-L-Pop	3M ESPE
Solobond M	Voco	Prompt-L-Pop (LP2)	3M ESPE
Stae	Southern Dental Industries	PSA	Dentsply-Detrey
Syntac Single- Component	Ivoclar Vivadent	Reactmer Bond	Shofu
Syntac Sprint	Ivoclar Vivadent	Xeno III	Dentsply-Detrey
		Xeno IV	Dentsply-Detrey
Self-etch adhesives		Glass ionomers	
<i>Two-step self-etch adhesives (sixth generation)</i>		Fuji 2 LC (GC Dentin Conditioner)	GC
AdheSE	Ivoclar Vivadent	Fuji Bond LC (GC Cavity Conditioner)	GC
ART Bond	Coltène Whaledent	Fuji Bond LL	GC
Clearfil Liner Bond 2	Kuraray	HIFI Master Palette (HI Tooth Cleanser)	Shofu
Clearfil Liner Bond 2V	Kuraray	Imperva Fluorobond	Shofu
Clearfil Protect Bond	Kuraray	Ketac-fil (Ketac Conditioner)	ESPE (now 3M ESPE)
Clearfil SE	Kuraray	Photac-fil (Ketac Conditioner)	ESPE (now 3M ESPE)
Denthesive 2	Heraeus Kulzer	Reactmer Bond	Shofu
NRC Prime&Bond NT	Dentsply-Detrey	Vitremer	3M ESPE (Vitremer Primer)
One Coat SE Bond	Coltène Whaledent		
OptiBond Solo Plus Self-Etch	Kerr		
Perme Bond F	Degussa AG		
Prisma Universal Bond 3	Dentsply-Detrey		
Pro Bond	Dentsply-Detrey		

References:

Fundamentals of Operative Dentistry. 3rd Edition. Summit et al. Pg. 203-205, 219-221, 223-227, 233-234.

**Packable composites have less polymerization shrinkage than hybrid composites.
Packable composites can be bulk cured in increments of 4-5mm.**

- a. Both statements are true.
- b. The first statement is true. The second statement is false.
- c. The first statement is false. The second statement is true.
- d. Both statements are false.

Answer: d

Packable composites were specifically designed for posterior use. These materials have increased viscosity to give them a consistency more similar to dental amalgam. Claims of enhanced clinical performance, reduced polymerization shrinkage and enhanced wear resistance have been made. Properties such as flexural strength, fracture toughness and polymerization shrinkage of packable composites are comparable, but not superior to those of other hybrid or reinforced microfilled resin composites currently available. Manufacturers have claimed that these materials can be bulk filled in increments of 5mm or greater. Research has clearly demonstrated that this is not true. Adequate polymerization of composites can only be accomplished with increments of 2mm or less. These materials may have a heavier consistency and a "drier" feel to them.

Reference:

Fundamentals of Operative Dentistry. 3rd Edition. Summit et al. Pg. 326.

What is/are true about enamel?

1. Direction of enamel prisms is perpendicular to the enamel surface
 2. Interrod crystals are almost perpendicular to rod crystals
 3. Crystal arrangement is closely packed hexagonal
 4. Rows of enamel prisms are often organized perpendicular to each other
 5. All of the above
-

Answer: 5

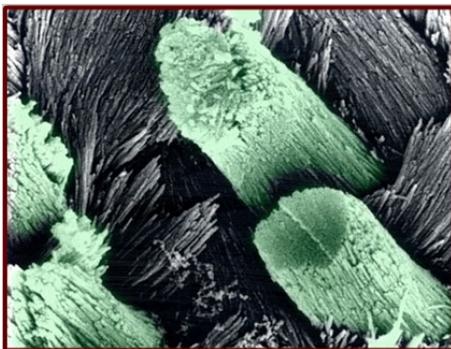
The antiquated term for enamel rod is **enamel prism**. Measuring 4 μm wide to 8 μm high, an enamel rod is a tightly packed, highly organized mass of [hydroxyapatite](#) crystals. In cross section, it is best compared to a keyhole with the top, or head, oriented toward the crown of the tooth and the bottom, or tail, oriented toward the root of the tooth. Knowing the orientation of enamel is very important in restorative dentistry because enamel unsupported by underlying [dentin](#) is prone to fracture and usually is avoided.

Enamel has 2 basic structural units:

- 1) cylindrical enamel rod- perpendicular to the enamel surface
- 2) interrod enamel – perpendicular to rod crystals. A “rod sheath” (organic material around $\frac{3}{4}$ of each rod) separates the 2 units.

The crystal within the cylinders of rod enamel run parallel to the long axis of the rods, which are, in turn, approximately perpendicular to the enamel surface.

The hydroxyapatite repeating unit is $\text{CA}^{10}(\text{PO}_6)^6(\text{OH})^2$, but often carbonate (CO_3^{2-}) is substituted in the lattice.



Enamel crystals: long and parallel organized hydroxyapatite crystals organized in bundles which are called prisms. Rows of enamel prisms are often organized perpendicular to each other.

Ref: Summitt, et al. Fundamentals of Operative Dentistry. 2006.
P1-9

Match the porcelain brand name on the left with the type of crystalline phase or mode of fabrication on the right:

A. In Ceram	1. heat-pressed
B. IPS Empress II	2. Alumina
C. Dicor	3. CAD/CAM and sintered
D. Lava	4. Castable ceramic
E. Captek	5. Leucite
F. Procera Zirconia	6. Zirconia

Answer:

- A. 2 In Ceram- Alumina
- B. 1 IPS Empress II- heat-pressed
- C. 4 Dicor- Castable ceramic
- D. 3 Lava- CAD/CAM and sintered
- E. 5 Captek- Leucite
- F. 6 Procera Zirconia- Zirconia

Dental ceramics are classified in 3 groups according with fusion range:

- High fusion: 1290-1370° C; 2350– 2500° F
- Medium Fusion: 1090- 1260° C; 2000– 2300° F
- Low fusion: 870-1070° C; 1600-1950° F

All Ceramic Systems classified by fabrication:

Sintered on metal foil:

Captek

Sintered:

- Ceramco 3
- Cerinate

Heat-pressed:

- IPS Empress
- IPS Empress II
- Empress Cosmo
- Finesse

Slip-cast and sintered:

- In Ceram
- In Ceram Spinell
- In Ceram Zirconia

CAD/CAM:

- Mark II
- ProCad

CAD/CAM and sintered:

- YZ blocs (in Vizion)
- Cercon Zirconia
- Lava
- Procera Alumina
- Procera Zirconia

Cast framework, sintered porcelain:

- Metal-ceramic

All Ceramic Systems and their recommended use and classification by crystalline phase

Leucite:

- Captek (crowns)
- Ceramco 3 (inlays, onlays, veneers)
- Cerinate (inlays, onlays, veneers, crowns)
- IPS Empress (inlays, onlays, veneers, crowns)
- Finesse (inlays, onlays, veneers, crowns)
- ProCad (inlays, onlays, crowns)
- Metal-ceramic

Alumina:

- In-Ceram (veneers, crowns)
- Procera Alumina
- In Ceram Spinell (Alumina Spinel) (veneers, crowns)

Zirconia:

- In Ceram Zirconia (Zirconia-alumina) (3 unit FPDs)
- YZ blocs (in Vizion) (crowns, FPDs)
- Cercon Zirconia (crowns, FPDs)
- Lava (crowns, FPDs)
- Procera Zirconia (crowns, FPDs)

Lithium (Li):

- IPS Empress II (Li-disilicate) (Anterior 3 unit FPDs, crowns)
- Empress Cosmo (Li-phosphate) (endodontic foundation)

Feldspar:

- Mark II (inlays, onlays, crowns)

All Ceramic Systems and Translucency:

Opaque:
Captek
In-Ceram
In Ceram Zirconia
YZ blocs (in Vizion)
Cercon Zirconia
Procera Alumina
Procera Zirconia
Metal Ceramic

Reference: Rosentiel, Land, Fujimoto. Contemporary Fixed Prosthodontics. Elsevier. 2006;p 774-800.

The Dicor system, utilizing a castable glass-ceramic was introduced in the 1980s. This glass-ceramic material was composed of SiO₂, K₂O, MgO, MgF₂, AlO₃ and ZrO₂. It employed the lost wax technique. After ceramming the material was aprox 55% tetrasilicic fluormica crystals. Not in used due to a high failure rate in the posterior area and development of other materials.

Spinel is a natural oxide of Mg²⁺ and Al³⁺ in which other metals can be substituted by these 2. It is used as a reinforcing agent specifically for crack deflection).

Alumina reinforced ceramic systems are more opaque than leucite reinforced.

Reference: Shillinburg. Fundamentals of Fixed Prosthodontics 3rd edition. 1997;p435-436

From the following two what kind of porcelain would you use for an anterior 3 unit FPD?

- a. IPS Empress II
- b. IPS Empress I

Answer: a

	Empress I	Empress II
Crystalline phase	Leucite	Lithium-disilicate
Recommended use	Inlays, onlays, crowns, veneers	Anterior 3 unit FPDs, crowns
Fabrication	Heat-pressed	Heat-pressed
Strength	Medium/low	High
Fracture toughness	Medium/low	High
Marginal fit	fair	fair
Translucency	Medium	Medium
Manufacturer	Ivoclar	Ivoclar

IPS Empress II- second generation of heat pressed dental ceramics. The material is pressed at 920 C and layered with a glass containing some dispersed apatite crystals.

Reference: Rosentiel, Land, Fujimoto. Contemporary Fixed Prosthodontics. Elsevier. 2006;p 774-800.

What is/are true about crown resistance form?

- a. prevents the restoration from becoming dislodged by forces parallel to the path of insertion
- b. resist dislodgement along an axis other than the path of placement
- c. the ideal crown preparation height in molar is 3.5-4 mm
- d. mesial and distal boxes and grooves increase resistance form
- e. all of the above
- f. b,c,d

answer: f. b,dc

Retention- quality of a prep that prevents the restoration from becoming dislodged by forces parallel to the path of insertion/ withdrawal

Variables:

Taper- Ideally 6° ; 5-22 $^{\circ}$ clinically acceptable; Tipping resistance increases when taper is reduced
Diameter
Height
Surface area-
Surface roughness- \uparrow restoration roughness \uparrow retention
Failure usually at the cement restoration interface
Boxes and grooves- mesial and distal to counteract lateral forces.

Resistance form: the features of a tooth prep that enhance the stability of a restoration and resist dislodgement along an axis other than the path of placement. Lateral forces tend to displace the restoration by causing rotation around the gingival margin.

Variables:

Height- in molars ideally 3.5-4mm; 3mm for ant and PMs
Diameter- - more diameter less resistance form
Taper

Reference: Rosentiel, Land, Fujimoto. Contemporary Fixed Prosthodontics. Elsevier. 2006;p 226-239; p. 826

You noticed that the alginate is setting faster than usual. What would be the most reasonable reason?

- Increase in mixing water volume
- Increase in mixing water temperature
- Increase in powder/water ratio
- Increase in spatulation time

answer: b

Alginates or irreversible hydrocolloids are sodium or potassium salts of alginic acid and therefore water soluble. They react with calcium sulfate to produce insoluble calcium alginate. **The reaction rate can be controlled by varying the temperature of the mixing water. Rate of set is doubled by an increase of 10 C.** Absorbs liquid by

imbibition and it gives off by syneresis water and salts to the atmosphere causing distortion of the impression. That's why impressions should be poured immediately. A greater bulk of material produces a more accurate impression.

What is true about composites?

- a. Microfilled are the most indicated composites for a for a cl. IV restoration
- b. Microfilled composites have 0.04 µm filler particles
- c. Hybrid composites have 0.04 µm and 1-4 µm particle fillers
- d. Hybrid have increased polishability compared with microfilled
- e. Esthet-X is an example of a nanofilled
- f. b,c,d,e
- g. All of the above

answer: f

Microfilled composites: 0.04 µm – 0.2 µm microfine filler particles

- High coefficient of thermal expansion – due to lower filler content; much higher volume % of polymer, higher shrinkage
- CTE= 55- 68 x 10⁻⁶ °C
- Contain silica with a very high surface area
- 25% by volume or 38% by weight silica
- Low tensile strength – reduced stiffness and increased rate of crack propagation (diametral tensile strength= 30-55 Mpa)
- High water sorption- 26- 30 µg/mm³
- High polymerization shrinkage 2-3%
- Modulus of elasticity in compression= 2.6- 4.8 GPa
- Increased polishability – due to smaller filler size rather than volume
- Indications: areas of high polishability, with no occlusal contacts. Ex. labial veneers with no incisal edge extension, Class V erosion lesion (enamel margins) – improved esthetics; not recommended for Class 4 restorations – but when a highly polished restoration is needed, a hybrid material may be used as a substructure that can be veneered with a microfilled composite.
- Contraindications: restoration with occlusal forces, high caries, cementum margins.
- Ex. A 110, Durafill VS, Renamel Microfill, and Matrixx Anterior Microfill, Heliomolar.

Hybrids : 0.04 µm to 1-4 µm particle fillers

- Blends the properties of macro and micro fillers – strength of macrofills with polishability of microfills – making smaller particles of uniform size and increasing the loading volume.
- Contain irregularly shaped glass (borosilicate glass; lithium or barium aluminium silicate; strontium or zinc glass), quartz or zirconia particles of uniform diameter.
- 60- 70% filler by volume
- 77% - 84% filler by weight
- Contain mostly fine particles (0.4 – 3 μm) and some microfine particles (0.04 – 0.2 μm)
- CTE= 25- 38 $\times 10^{-6} \text{ } ^\circ\text{C}$
- Modulus of elasticity in compression= 5.5- 8.3 GPa
- water sorption- 5 - 17 $\mu\text{g}/\text{mm}^3$
- Microhybrids or nano filled composites: less than 1 μm average particle size: ex. Esthet-X
- Increased compressive strength
- Decreased polymerization shrinkage- (0.7 – 1.4%)
- Increased hardness
- Increased wear resistance
- Indications: posteriors, Class III/IV with occlusal contacts
- Ex. Point-4, Tetric Ceram, Venus, Z 100
-

Nanofilled/ Nanohybrid: 2-20 nm silica; 0.6 nm zirconi-silica nanoclusters

- nanofill and nanohybrid composite resins include: Filtek Supreme, Simile, Esthet-X Improved, and TPH.

Enamel, dentin, amalgam, composites:

- Knoop Hardness:
 - Composites (22-80 Kg/mm^2)
 - Enamel (343 kg/mm^2)
 - Amalgam (110 kg/mm^2)
- Polymerization shrinkage stresses comp-tooth up to 13MPa
- Polymerization reaction 24h
- % double bonds that react: 35- 80%
- Activation of initiator camphorquinone @ 470 nm
- Accelerator: organic amine
- CTE enamel= 11.4 $\times 10^{-6} \text{ } ^\circ\text{C}$
- CTE dentin= 8.3 $\times 10^{-6} \text{ } ^\circ\text{C}$
- Modulus of elasticity in compression:
 - Amalgam 62 GPa
 - Dentin 19 GPa

- 83 Gpa enamel

Ref: Summitt, et al. Fundamentals of Operative Dentistry. 2006.
P263-264

Craig's Restorative Dental Materials. 2006. p189-203

Match each statement on the left with the type of amalgam on the right that is most appropriate.

- | | |
|---|-------------------------------|
| ___ Easier to achieve contact in a class II cavity. | A. Admixed amalgam, high Cu |
| ___ Dispersalloy. | B. Spherical amalgam, high-Cu |
| ___ Easier to seal margins if condensed well. | C. Low copper amalgam |
| ___ Valiant. | |
| ___ The mercury content is higher. | |
| ___ Has increased tarnish, corrosion, and creep. | |
| ___ Requires more force on condensation. | |
| ___ Needs more time in the triturator. | |

- | | |
|---|--------------------------------------|
| ___ Easier to achieve contact in a class II cavity. | A. Admixed amalgam, high-Cu |
| ___ Dispersalloy. | A. Admixed amalgam, high-Cu |
| ___ Easier to seal margins if condensed well. | B. Spherical amalgam, high-Cu |
| ___ Valiant. | B. Spherical amalgam, high-Cu |

- ___ The mercury content is higher.
A. Admixed amalgam, high-Cu
- ___ Has increased tarnish, corrosion, and creep.
C. Low copper amalgam
- ___ Requires more force on condensation.
A. Admixed amalgam, high-Cu
- ___ Needs more time in the triturator.
B. Spherical amalgam, high-Cu

In general, **admixed amalgams** (containing both spherical and lathe cut particles) require less time in the triturator (8-10s), and more readily achieve good contacts in class II cavity preparations. They have a slightly higher mercury content than spherical amalgams because the particles do not pack together as closely when the setting reaction is taking place. Brands include Dispersalloy, Contour, Valiant PhD and Megalloy.

In contrast, **spherical amalgams** require more time in the triturator (10-12s), require less force on condensation, and exhibit better marginal closure when condensed well. They have a slightly lower mercury content due to the more intimate packing of particles in the final alloy. Examples include Tytin and Valiant.

All amalgam alloys on the US market to day are considered high copper alloys and contain 13-30% copper. Adding this to the alloy significantly decreases the gamma-two phase (Sn_{7-8}Hg) in the final product; as this material has the highest corrosion rate, static creep and tarnish, the resultant physical properties are improved.

Reference:

- Craig RG, Powers JM. *Restorative dental materials*. 11th Ed. Mosby, Inc. 2002.

Which of the following are true about “compomers?” Choose all that apply.

- a. They are also known as polyacid-modified glass ionomers.
- b. Like composite resins, darker shades tend to cure less effectively with visible light as the depth from the surface is increased.
- c. Once in place, they take up water *in situ*, which activates the glass ionomer-type reaction and causes the release of fluoride.
- d. Water uptake causes further strengthening of the material as it activates the glass ionomer-type reaction.
- e. Water uptake tends to cause discoloration of the material.
- f. Compomers are indicated for class I, II and V cavity preparations, as pit and fissure sealants, and as orthodontic band cements.

g. These materials are especially useful in permanent teeth.

- A. a, b, c, d, e.
- B. b, c, e, f.
- C. b, d, e, f, g.
- D. a, b, c, e, f, g.
- E. All of the above.
- F. None of the above.

Answer: B. b, c, e, f.

Compomers are also known as polyacid-modified resin composites, although the former name doesn't describe the materials as accurately as the latter. The material contains no water, and when placed, is initially cured with visible light. After the initial set, water is absorbed in vivo which activates the glass ionomer-type reaction, leading to the release of ions and fluoride in clinically significant amounts. Like composite resins, darker shades tend to cure less effectively as depth of material is increased, so incremental placement is indicated.

While water absorption is a distinctive feature and leads to fluoride release, it also weakens the compressive and flexural strengths of the material, making their physical properties inferior to traditional resin composites. Obviously, as water is absorbed, pigments can be taken up as well, leading to discoloration.

These materials have performed well in primary teeth and tend to have good handling properties. They have also performed adequately as pit and fissure sealants, as a cement for orthodontic bands, and in class I, II and V cavity preparations.

Reference: Nicholson JW. Polyacid-modified composite resins ("compomers") and their use in clinical dentistry. *Dental Materials*. June 2006. 19; Epub ahead of print.

The gingival preparation depth for porcelain veneers should always be 0.3-0.5mm to ensure some enamel remains in this area for bonding. The strongest and most predictable bond with porcelain veneers is that to enamel.

- A. Both statements are true.
- B. The first statement is true, the second is false.
- C. The first statement is false, the second is true.
- D. Both statements are false.

Answer: C. The first statement is false, the second is true.

While the bond to enamel is the strongest bond with porcelain veneers, it may not always be possible to limit the preparation depth in the gingival area to 0.5mm. In cases of heavy staining (tetracycline), it may be necessary to increase the depth to 0.7mm. As a rule of thumb, the more dentin the clinician exposes during preparation, the poorer the bond of the veneer will be and the poorer the ultimate stress distribution during function. If the margins of the veneer are completely in enamel, whether or not dentin is exposed in the center of the preparation becomes less important.

In the case of maxillary veneers, the finish line should be placed at the gingival margin or slightly subgingival. In mandibular veneer cases, the soft tissues tend to be thin and fragile, and since this is a non-visible area for almost everyone, margins on these teeth should almost always be kept supragingival.

The finish lines should not be placed in the contact area. Contacts should either be maintained or completely broken to allow for adequate cleaning and finishing. In cases with darker staining, breaking the contact is indicated to help achieve a better cosmetic result. The decision on whether or not to include the incisal edge must be made on a case-by-case basis and should take into consideration the inclination of the teeth, parafunctional habits and occlusion.

Reference: Summit JB, Robbins JW, Schwartz RS. *Fundamentals of operative dentistry: a contemporary approach*. 2nd Ed. Quintessence Publishing Co, Inc. 2001.

Which of the following are true concerning resin-modified glass ionomers?

- A. They were developed to address the limitations of traditional glass ionomers including technique sensitivity, moisture sensitivity, short working time, and inferior esthetic properties.
- B. They still contain ion-leachable fluoroaluminosilicate glass, but also contain resin monomers and may be light activated via camphoroquinone; this improves the working and setting properties as well as the final esthetics.
- C. Because they contain composite resins and release fluoride, dentists should abandon traditional composite resins and traditional glass ionomers.
- D. All of the above.
- E. A and B only.

Answer: E. A and B only.

Resin-modified glass ionomers were developed to address the limitations of traditional glass ionomers including technique sensitivity, moisture sensitivity, short working time, and inferior esthetic properties. They still contain ion-leachable fluoroaluminosilicate glass, but also contain resin monomers and may be light activated via camphoroquinone; this improves the working and setting properties as well as the final esthetics. They can be utilized as direct restorative materials, but are commonly employed as cements/luting agents (ie: Fuji series).

They differ from polyacid-modified composite resins (compomers) because the initial setting reaction is the glass ionomer reaction (SLOWLY), which allows for increased working time. When the clinician is ready, he/she activates the photoinitiator to polymerize the resin groups and speed the final setting. In general, they are easier to use than conventional glass ionomers, their physical properties are better than conventional glass ionomers (including compressive/tensile/flexural strengths, fracture toughness, wear resistance, fatigue resistance, bond strengths to enamel/dentin/resin-based restorative materials, marginal adaptation, and microleakage), they are less water sensitive, and they have comparable fluoride release to traditional glass ionomers. Physical properties do remain inferior to composite resins.

Reference: Summit JB, Robbins JW, Schwartz RS. *Fundamentals of operative dentistry: a contemporary approach*. 2nd Ed. Quintessence Publishing Co, Inc. 2001.

Which of the following are true concerning bleaching?

- A. Vital bleaching is generally a safe procedure.
- B. Nonvital bleaching may be completed in the office or between visits.
- C. “Walking bleach” refers to patients who wear bleaching trays while traveling from place to place (ie: during their commute).
- D. All of the above.
- E. A and B only.

Answer: E. A and B only.

Vital bleaching is generally a safe procedure. It can be completed between visits by providing trays and bleach to the patient. The dentist can also perform the service in-office, usually with access to stronger bleaching agents – in these cases isolation of the soft tissues is key (rubber dam) as many of the stronger agents can cause damage. Regardless of the technique, the end point is generally the same – whiter teeth. The decision about which technique to use should be made depending on how much time, inconvenience and expense the patient is willing to tolerate. The most common complaint from patients is sensitivity.

Nonvital bleaching is indicated in endodontically treated teeth that have become discolored. The dentist should make sure that no residual gutta percha or sealer remains in the pulp chamber. The dentist should place a barrier between the root canal filling and the pulp chamber (usually a glass ionomer material) between the CEJ and a point about 2mm apical to this; doing so has been shown to prevent external root resorption believed to occur due to seepage of bleaching agents through the cervical area of the tooth. Sodium perborate is the agent of choice as superoxol has fallen out of favor. When a bleaching agent is placed in the tooth and the patient reappointed about a week later for changing/removal of the solution, the term “Walking Bleach” applies – not when patients bleach with trays while moving from place to place.

Bleaching of any kind has been shown to interfere with normal dentinal bonding – be sure to schedule the patient for such procedures at least 7-14d after completion of tooth whitening.

Reference: Summit JB, Robbins JW, Schwartz RS. *Fundamentals of operative dentistry: a contemporary approach*. 2nd Ed. Quintessence Publishing Co, Inc. 2001.

Light-emitting diode curing lights emit light over a range of wavelengths while quartz-tungsten-halogen lights produce light at a very narrow spectral range.

- A. True.
- B. False.

Answer: B. False.

Just the opposite is true: light-emitting diode or LED curing lights produce light over a narrow spectral range. If you use this light in your clinical practice, you must make sure the unit you purchase produces the right wavelength of light to activate your photoinitiators. For camphoroquinone-based materials, $\lambda=470\text{nm}$ should be the main focus. LED lights are appealing to the dentist because they produce less heat than QTH, have good longevity, and have relatively constant bulb output in terms of power density.

Quartz-tungsten-halogen or QTH curing lights are both affordable and effective, but have some drawbacks relative to LED's. They do produce heat which can have ramifications in the dental pulp, and their bulbs emit diminishing power intensity light over time; consequently, a radiometer should be present in the office and used at least weekly to ensure that light output is adequate for curing VLC materials.

Both QTH and LED lights have been shown to be clinically effective.

Reference: Vandewalle KS, Roberts HW, Tiba A, Charlton DG. Thermal emission and curing efficiency of LED and halogen curing lights. Operative Dentistry. 2005; 30(2): 257-264.

ORAL MED / ORAL PATH

Xerostomia, conjunctivitis, and enlarged salivary glands are characteristic of:

- A. Sjogren's syndrome
- B. Diabetes
- C. hyperparathyroidism
- D. hypothyroidism

Answer:

A

The typical features of Sjogren's syndrome, dryness of the mouth and eyes, are a result of hypofunction of the salivary and lacrimal glands. It has been reported that about half the patients with Sjogren's syndrome manifest clinically obvious swelling of the parotid and submaxillary glands. Diabetes may be manifested by xerostomia and hyperplastic salivary glands, but not conjunctivitis. Almost all patients with hyperparathyroidism have bone lesions with a ground glass appearance. The patient with hypothyroidism may exhibit cretinism, if a child, or myxedema, of an adult.

Regezi and Sciubba, 3rd ed., 54 and 235-8.

In a xerostomic patient, what meds would you NOT prescribe or agents would you tell the patient to AVOID:

- a. alcohol
 - b. tobacco
 - c. drink 8-10 glasses of water
 - d. sugarless gum
 - e. coffee and tea
 - f. Pilocarpine HCl solution
-
- 1. all the above
 - 2. a, b, c
 - 3. c, d, f
 - 4. a, d, e
 - 5. a, b, e

Answer

5 – a, b, e

Chewing sugarless gum and sucking on sugarless mints are conservative methods to temporarily stimulate salivary flow in patients with xerostomia. Patients are cautioned against intaking products containing sugar. Patients should be counseled to drink plenty of water, at least 8 to 10 glasses a day and avoid diuretics such as

caffeine, tobacco, and alcohol. Systemic administration of pilocarpine or cevimeline effectively stimulates salivary acinar tissue.

Little et al, 6th ed Dental Management of the medically compromised patient; 2002, pp 495-496, 554.

Which one(s) is/are FALSE?

A. Amelogenesis Imperfecta has a translucent, bluish feature that makes it easy to recognize.

B. Pulp chambers and canals are enlarged or obliterated, radiographically, in dentinogenesis imperfecta

C. The enamel in Dentogenesis Imperfecta is normal.

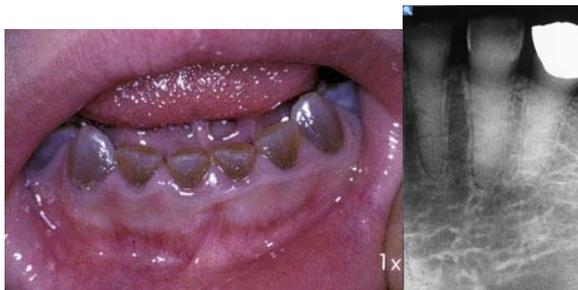
D. Dentin dysplasia is associated with osteogenesis imperfecta.

E. Bulbous crowns and thin roots, radiographically, are usually associated with Amelogenesis Imperfecta.

- a. all the above
- b. A, B, E
- c. A, B, C
- d. C, D, E
- e. A, D, E
- f. E only

Answer: 5. A, D, E

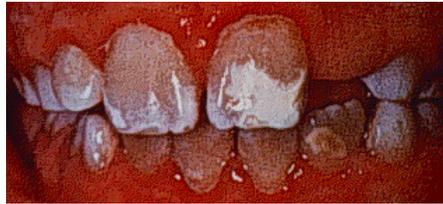
Dentinogenesis imperfecta is a hereditary developmental disturbance of the dentin in the absence of any systemic disorder. Similar changes may be seen in conjunction with **osteogenesis imperfecta** (not dentin dysplasia). Generally the teeth appear opalescent in color. Radiographically, they exhibit bulbous crowns, obliteration of the pulp, and enamel hypoplasia



Amelogenesis imperfecta encompasses complications in the development of enamel. Radiographically, the dentin appears normal. There are 4 main classes which are based on the enamel formation and when the defect took place:



¹hypoplastic amelogenesis imperfecta,



²hypomaturational amelogenesis imperfecta,



³hypocalcified amelogenesis imperfecta,
and ⁴hypomaturational/hypoplastic amelogenesis imperfecta.

Neville, Damm, et al. *Oral and Maxillofacial pathology* 2nd ed. 2002; 89-100

Basal Cell Carcinoma is the least most common of the skin cancers. It is locally invasive predominantly found on the head and neck.

- A. First and second are true
- B. Only the first is true
- C. Only the second is true
- D. both are false

Answer: C

Basal cell Carcinoma is the most common skin cancer and the most common of all cancers. It is locally invasive, slowly spreading primary epithelial malignancy that arises from the basal cell layer of the skin and its appendages. About 85% is found on the head and neck.



Basal cell carcinoma (BCC) is named for the round basal cells located in the lower part of the epidermis (the outermost layer of the skin), from which it arises. Like melanoma, the cancer has been increasing at a dramatic rate.

Prevalence and Risk Factors. Basal cell carcinoma occurs in 800,000 people every year, and 30% of people, almost exclusively Caucasians, can expect to have basal cell carcinoma, on average, by age 55. Some experts posit that genetic mutations caused by factors other than sunlight may also contribute to basal cell cancer.

Interestingly, a 2001 study reported that people with more wrinkles were less likely to develop basal cell carcinomas, even among high-risk groups. Some experts suggest that people prone to wrinkles may respond to sun exposure with biologic mechanisms that protect against basal cell carcinoma. More research is needed confirm this.

Characteristics. The lesions usually develop later in life in areas that have received the most sun exposure, such as the head, neck and back, and especially the nose. About a third of basal cell carcinomas appear in areas not exposed to the sun.

Basal Cell Carcinoma

- They usually appear as a round area of thickened skin that does not change color or cause pain or itching.
- Very slowly, the lesion spreads out and develops a slightly raised edge, which may be translucent and smooth. Infrequently, basal cell carcinomas resemble malignant melanomas in color.
- Eventually, the center becomes hollowed and covered with a thin skin, which can become sore and open.
- A form known as aggressive-growth basal cell carcinoma resembles a scar with a hard base. This type is more likely to spread and must be treated very aggressively.

- Neville, Damm. Oral and Maxillofacial Pathology 2nd ed. Quintessence Publishing 2002:372-374

- www.lifespan.org/adam/graphics/images/en/9099.jpg

The safest drugs to administer during pregnancy are (select one answer):

- a) ASA, tetracycline, valium, lidocaine
- b) acetaminophen, codeine, streptomycin, mepicivaine
- c) ASA, tetracycline, codeine, mepivicaine
- d) acetaminophen, codeine, clindamycin, lidocaine.

Answer: d

Acetaminophen is the best non-opiate medication to use. Codeine is the safest opiate. Clindamycin is the best choice of antibiotic of the answers provided. Lidocaine is the safest anesthetic. The principal concern is that the drug could potentially cross the placenta and be toxic or teratogenic to the fetus. Any drug that is a respiratory depressant can cause maternal hypoxia, resulting in fetal hypoxia, injury or death.

Analgesics – analgesic of choice during pregnancy is acetaminophen. ASA and NSAIDS have the risks for constriction of the ductus arteriosus, as well as postpartum hemorrhage and delayed labor. Prolonged or high doses of opioids are associated with respiratory depression. Codeine – Class C/D; Valium – Class D

Antibiotics – Penicillins, erythromycin and cephalosporins (1st and 2nd generation) are considered safe to the pregnant patient. Tetracycline is contraindicated during pregnancy because they bind to hydroxyapatite, causing brown discoloration of teeth, hypoplastic enamel, inhibition of bone growth, and other skeletal abnormalities.

Anxiolytics – few anxiolytics are considered safe, however, a single dose exposure of nitrous oxide oxygen for less than 35 minutes has not been associated with any human fetal anomalies. Repeated or prolonged exposure should be avoided. Always maintain at least 50% oxygen and the safest periods of administration are during the 2nd and 3rd trimester.

Anesthetics – administration of LA are relatively safe, however, limit the dose to the amount required.

Food and Drug Administration categorization of prescription drugs are for pregnant patients based on their risk of fetal injury. There are 5 categories:

- A. [Generally considered safe] Controlled studies in pregnant women fail to demonstrate a risk to the fetus in the first trimester with no evidence of risk in later trimesters. The possibility of fetal harm appears remote.
Example: Multivitamins
- B. [Caution advised] Either animal-reproductive studies have not demonstrated a fetal risk but there are no controlled studies in pregnant women, **OR** animal-reproduction studies have shown an adverse effect that was not confirmed in controlled studies in women in the first trimester and there is no evidence of a risk in later trimesters.
Examples: Pen VK, Lidocaine, Prednisone
- C. [Weigh risk and benefit] Animal studies have shown adverse fetal effect(s) but no controlled human studies **AND** there are no controlled studies in women, or studies in women and animals are not available. Drugs should be given only if the potential benefits justify the potential risk to the fetus.
Examples: Glucotrol, Advair

D. [Weigh risk and benefit] Positive evidence of human fetal risk; maternal benefit may outweigh fetal risk in serious or life-threatening situations; see package insert for drug-specific recommendations.

Example: Diazepam, Barbiturates

X. [Contraindicated] Positive evidence of serious fetal abnormalities in animals, humans, or both; fetal risks clearly outweigh maternal benefits.

Examples: Casodex (antineoplastic agent for prostate cancer)

Malamed SF, 5th ed *Local Anesthesia*; 2004, pp146-147;

Little et al, 6th ed *Dental Management of the medically compromised patient*; 2002, pp 303-312.

Wynn RL et al, 9th ed *Drug Information Handbook for Dentistry 2003*, p 10.

Which of the following are NOT true concerning oral melanoacanthoma:

- A. Benign common acquired pigmentation of the oral mucosa
- B. Seen almost exclusively in black females
- C. Most common in the 5th to 6th decade of life
- D. Buccal mucosa is the most common site of occurrence
- E. Lesion is dark brown to black and smooth or slightly raised

- i A & B
- ii B & C
- iii C & D
- iv D & E
- v A & C

Answer is: v. A & C

Oral melanoacanthoma (melanoacanthosis) is a benign and uncommon acquired pigmentation of the oral mucosa characterized by dendrite melanocytes dispersed throughout the epithelium. Lesion appears to be a reactive process and is unrelated to the melanoacanthoma of skin. **Oral melanoacanthoma is seen almost exclusively in blacks, shows a female predilection,** and is **most common during the 3rd and 4th decades** of life. **The buccal mucosa is the most common site of occurrence.** The **lesion is smooth, flat or slightly raised, and dark-brown to black in color.** Lesions often demonstrate a rapid increase in size, and they occasionally reach a diameter of several centimeters within a period of a few weeks.



Reference:

Neville BW, Damm DD, et al. Oral and Maxillofacial Pathology. 2nd edition 2002. pp 331

Which of the following is NOT true concerning a Central Giant Cell Granuloma?

- A. May be associated with aneurysmal bone cyst
 - B. More common in older adults
 - C. May occasionally behave in a more aggressive fashion (Central Giant Cell Tumor)
 - D. Microscopically identical to the “brown tumor” of hyperparathyroidism
 - E. Surgical excision may be necessary for larger lesions
-

Answer is: **B**

Central Giant Cell Granuloma

A reactive granulomatous proliferation containing multinucleated giant cells and may represent a reparative response to inflammation within the bone. Of clinical significance; They **may be associated with aneurysmal bone cyst**, may **occasionally behave in a more aggressive fashion** and may be **microscopically identical to the “brown tumor”** of hyperparathyroidism. Curettage is the treatment of choice for smaller lesions, while **surgical excision may be necessary for larger lesions**. Teeth adjacent to lesion are asymptomatic and vital, there may be cortical expansion and are **more common in young adults**.

An aneurysmal bone cyst is an expansile osteolytic lesion with a thin wall, containing blood-filled cystic cavities. The term aneurysmal is derived from its radiographic appearance

Aneurysmal bone cyst

Trauma is considered an initiating factor in the pathogenesis of some cysts in well-documented cases involving acute fracture. Local hemodynamic alterations related to venous obstruction or arteriovenous fistulae that occur after an injury are important in the pathogenesis of an aneurysmal bone cyst.

The lesion is a component of, or arises within, a preexisting bone tumor in about one third of cases; this finding further substantiates the fact that aneurysmal bone cysts occur in an abnormal bone as a result of associated hemodynamic changes. An aneurysmal bone cyst can arise from a preexisting chondroblastoma, a chondromyxoid fibroma, an osteoblastoma, a giant cell tumor, or fibrous dysplasia. Less frequently, it results from some malignant tumors, such as osteosarcoma, chondrosarcoma, and hemangioendothelioma.

Aneurysmal bone cysts may be purely intraosseous, arising from the bone marrow cavity. In this case, they are primarily cystic and slowly expand into the cortex. They may be extraosseous, arising from surface of bones, eroding adjacent cortex, and extending into the marrow space.

Four phases of pathogenesis are recognized, as follows:

- Osteolytic initial phase
- Active growth phase, which is characterized by rapid destruction of bone and a subperiosteal blow-out pattern
- Mature stage, also known as stage of stabilization, which is manifested by formation of a distinct peripheral bony shell and internal bony septae and trabeculae that produce the classic soap-bubble appearance.
- Healing phase with progressive calcification and ossification of the cyst and its eventual transformation into a dense bony mass with an irregular structure

Brown tumors are tumors of bone that arise in settings of excess osteoclast activity, such as hyperparathyroidism[1], and consist of fibrous tissue, woven bone and supporting vasculature, but no matrix. They are radiolucent on x-ray. The osteoclasts consume the trabecular bone that osteoblasts lay down and this front of reparative bone deposition followed by addition resorption can expand beyond the usual contour of the bone, involving the periosteum and causing bone pain. The characteristic brown coloration results from hemosiderin deposition into the osteolytic cysts.



Reference:

Newland JR. Oral Hard Tissue Diseases. Lexi-Comp's Dental Reference Library, 2nd edition. 2007
Pg 23.

Neville BW, Damm DD, et al. Oral and Maxillofacial Pathology. 2nd edition 2002. pp 544-547

Which of the following is NOT true concerning a Calcifying Epithelial Odontogenic Tumor?

- A. Surgical resection is the treatment of choice
- B. Microscopic examination of the lesion is necessary to confirm the diagnosis
- C. Also known as a Pindborg tumor
- D. Commonly associated with the apex of an unerupted mandibular molar
- E. Diff Dx: includes Odontoma, Adenomatoid odontogenic tumor and Calcifying odontogenic tumor.

The answer is: **D**

A Calcifying Epithelial Odontogenic Tumor (CEOT) is a benign neoplasm that arises from the reduced enamel epithelium that lines the dental follicle or from remnants of the dental lamina. It is a unilocular or multilocular lesion with focal or diffuse calcifications producing a mixed radiolucent-radiopaque appearance. **It is commonly associated with the crown of an unerupted mandibular molar.** It is more common in adults and cortical expansion may be present. **Differential Diagnosis may include Odontoma,**

Adenomatoid Odontogenic Tumor (AOT) and Calcifying Odontogenic Cyst (COC). CEOT is also known as a Pindborg tumor. CEOT is diagnosed with microscopic examination of the lesion. Complete surgical resection is the recommended treatment of choice.



Reference:

Newland JR. Oral Hard Tissue Diseases. Lexi-Comp's Dental Reference Library, 2nd edition. 2007 Pg 87.

Neville BW, Damm DD, et al. Oral and Maxillofacial Pathology. 2nd edition 2002. pp 623-625

Concerning Periapical Radiolucent Lesions, all of the following will usually have non-vital pulps EXCEPT?

- A. External Root Resorption
- B. Periapical Cemento-Osseous Dysplasia
- C. Periapical Cyst
- D. Periapical Granuloma
- E. Focal Sclerosing Osteomyelitis

- i A & B
 - ii B & C
 - iii B & D
 - iv A & C
 - v D & E
-

The Answer is: i **A & B**

Periapical Granuloma (Chronic Apical Periodontitis) presents radiographically as a circumscribed radiolucent lesion at the root apex. The lesion may occasionally be displaced laterally and the tooth may show deep caries, a large restoration, or evidence of previous endodontic therapy. The tooth will be **nonvital** and will not be painful to percussion.

Periapical Cyst (Radicular Cyst) is a proliferation of odontogenic epithelium in a pre-existing periapical granuloma. The odontogenic epithelium originates from the rest of Malassez. It appears as a circumscribed radiolucent lesion at the root apex. The lesion may occasionally be displaced laterally and the tooth may show deep caries, a large restoration, or evidence of previous endodontic therapy. The tooth will be **nonvital** and not painful to percussion.

External Root Resorption (Idiopathic External Resorption) presents as an irregular destruction of the root apex with an ill-defined area of periapical radiolucency. Multiple etiologic factors including trauma, orthodontic therapy, pressure from an impacted tooth, tooth reimplantation, and expansion of a cyst or tumor. The tooth will almost always be **vital**, but may be sensitivity to percussion.

Focal Sclerosing Osteomyelitis (Condensing Osteitis) presents as a circumscribed radiolucent lesion at the root apex of a tooth with a deep carious lesion. Chronic Osteomyelitis that develops at the root apex of a tooth with chronic pulpitis secondary to deep caries. Mandibular molars and premolars most frequently involved. The pulps are almost always **nonvital**.

Periapical Cemento-Osseous Dysplasia (Cemental Dysplasia) presents as circumscribed radiolucencies at the ends of the roots of multiple mandibular anterior teeth. Teeth involved are usually free of caries or restorations. The lesions are usually asymptomatic and are more common in middle-aged African-American females. The teeth will test **vital**.

References:

Newland JR. Oral Hard Tissue Diseases. Lexi-Comp's Dental Reference Library, 2nd edition. 2007 Pp15-19.

Neville BW, Damm DD, et al. Oral and Maxillofacial Pathology. 2nd edition 2002. pp 804-811

A well circumscribed margin is usually associated with a slowly expanding lesion such as a periapical cyst. Ragged margins are often associated with rapidly growing malignancies.

- A. First statement is true, the second statement is false
- B. First statement is false, the second statement is true
- C. Both statements are true
- D. Both statements are false

The answer is: **C**

Circumscribed margin-The margin of an intra-osseous lesion which is distinct when viewed on a radiograph. **A circumscribed margin is usually associated with a slowly expanding lesion such as a periapical cyst.**

Ragged margin-The margin of an intra-osseous lesion which is indistinct. **Ragged margins are often associated with rapidly growing malignancies.**

References:

Newland JR. Oral Hard Tissue Diseases. Lexi-Comp's Dental Reference Library, 2nd edition. 2007 Pp11-12.

Which of the following white lesions can be wiped off ?

- A. White Sponge Nevus
- B. Lichen Planus
- C. Acute Pseudomembranous Candidiasis
- D. Chronic Hyperplastic Candidiasis
- E. Frictional Keratosis (Benign Hyperkeratosis)

White lesions that can be scraped off

White coated tongue
Pseudomembranous candidiasis
Morsicatio
Thermal burn
Sloughing traumatic lesion
Toothpaste or mouthwash reaction
Chemical burn
Secondary Syphilis
Diphtheria

White lesions that can't be scraped off

Linea alba
Leukoedema
Leukoplakia
Tobacco pouch keratosis
Actinic cheilosis
Lichen Planus
Nicotine Stomatitis
Hairy Leukoplakia
Hyperplastic candidiasis
White sponge nevus
Benign Hyperkeratosis

Reference:

Newland JR. Oral Soft Tissue Diseases. Lexi-Comp's Dental Reference Library, 3rd edition. 2005 Pg 17-34.

Neville BW, Damm DD, et al. Oral and Maxillofacial Pathology. 2nd edition 2002. pp 788-789

**Match the following characteristics with the appropriate soft tissue enlargement.
You may have more than one answer per characteristic.**

- | | |
|--|--------------------|
| _____ 1. Recommended treatment is surgical excision. | a. Mucocele |
| _____ 2. Is usually painless. | b. Ranula |
| _____ 3. Usually caused by a sialolith. | |
| _____ 4. Usually is blue in color. | |
| _____ 5. Associated with trauma to the excretory duct of a minor salivary gland. | |
| _____ 6. Marsupialization is a recommended treatment. | |

Answer:

- | | |
|--|--------------------|
| <u> a </u> 1. Recommended treatment is surgical excision. | a. Mucocele |
| <u> a, b </u> 2. Is usually painless. | b. Ranula |
| <u> b </u> 3. Usually caused by a sialolith. | |
| <u> a, b </u> 4. Usually is blue in color. | |
| <u> a </u> 5. Associated with trauma to the excretory duct of a minor salivary gland. | |
| <u> b </u> 6. Marsupialization is a recommended treatment. | |

A mucocele is caused by damage to the excretory duct of a minor salivary gland. Saliva escapes into the adjacent connective tissue causing a chronic inflammatory reaction. Visually you will see solitary, circumscribed sessile nodule. Superficial lesions are typically blue in color, deeper lesions are pink. The surface is smooth. Most often they occur on the lower lip. These lesions are soft to palpation, usually painless, persistent, they may fluctuate in size and the patient usually reports history of trauma. Recommended treatment is local surgical excision and removal minor salivary glands at the site to reduce the likelihood of recurrence.

A ranula is usually caused by a sialolith or local trauma to the duct of the submandibular salivary gland. Saliva escapes into the connective tissue of the floor of the mouth causing a chronic inflammatory lesion. Visually the lesion will be a circumscribed, blue, sessile nodule usually covered by smooth mucosa. They occur on the floor of the mouth away from the midline. Occasionally they may extend below the

the mylohyoid muscle to produce a swelling in the upper neck (plunging ranula). They are soft to palpation, usually painless, persistent and the patient may report a history of local trauma. Recommended treatment is marsupialization and removal of submandibular gland tissues in some cases.

Reference: Lexi-comp's Oral Soft Tissue Diseases. 3rd Edition. pgs. 115-116.

All of the following are important considerations when submitting a biopsy specimen, except?

- a. A description including location, size, shape and color of the lesion.**
- b. Inclusion of normal tissue as part of the specimen.**
- c. A differential diagnosis.**
- d. A photograph of the lesion.**
- e. None of the above.**

Answer: e

All of the following should be included with your biopsy if possible: Pertinent information from the patient's health history, a description of the lesion including size, shape, location and color of the lesion, adjacent normal tissue, a differential diagnosis, a photograph of the lesion.

Reference: wo-pub2.med.cornell.edu/cgi-bin/WebObjects/PublicA.woa/1/wa/viewHContent?website=wmc+physicians&conte...

Text- Contemporary Oral and Maxillofacial Surgery. 3rd Edition. 1998. Pgs. 526-28.

Match the features with the appropriate condition. More than one answer per feature is possible.

- | | |
|--|----------------------|
| ___ 1. Vesicles are intraepithelial. | a. Pemphigus |
| ___ 2. Prognosis is good to excellent. | b. Pemphigoid |
| ___ 3. There is no detectable circulating Ab. | |
| ___ 4. Target tissue is the basement membrane. | |

- ___ 5. Displays a positive Nikolsky's sign.
- ___ 6. Occurs with greatest frequency in middle-aged women.

Answer:

- a 1. Vesicles are intraepithelial. a. Pemphigus
- b 2. Prognosis is good to excellent. b. Pemphigoid
- b 3. There is no detectable circulating Ab.
- b 4. Target tissue is the basement membrane.
- a, b 5. Displays a positive Nikolsky's sign.
- b 6. Occurs with greatest frequency in middle-aged women.

General features of pemphigus and pemphigoid		
Feature	Pemphigus	Pemphigoid
Detectable circulating Ab	Yes, IgG	No
Tissue-bound autoantibody	Yes, IgG (also complement)	Yes, IgG (also IgA, complement)
Target tissue	Desmosomes	Basement membrane
Vesicles	Intraepithelial	Subepithelial
Sites affected	Oral mucosa, skin	Oral mucosa, eye, genitals
Nikolsky's sign	Yes	Yes
Treatment	Systemic steroids	Systemic or topical steroids
Prognosis	Fair to good	Good to excellent

Pemphigus is an immunologic defect that causes the production autoantibodies against desmosomes which hold adjacent epithelial cells together. Destruction of desmosomes causes adjacent epithelial cells to separate (acantholysis) producing an epithelial blister. Visually you will see blisters which rupture and form erosions and ulcerations. Any oral mucosa site can be affected. Gingival lesions produce desquamative gingivitis. It occurs with equal frequency in men and women, and is more common in people of Jewish decent. It is associated with severe discomfort. Patients display a positive Nikolsky's sign (the formation of a blister on apparently normal skin after slight mechanical pressure). Incisional biopsy should be performed with half of the tissue placed in formalin for routine histopathologic examination and half in Michel's solution for direct immunofluorescent studies. Direct immunofluorescent studies may be necessary to differentiate pemphigus from erosive lichen planus and pemphigoid. Direct immunofluorescence reveals the presence of IgG and compliment C3 in the intercellular

spaces between adjacent epithelial cells. Autoantibodies can be demonstrated in patients' serum by indirect immunofluorescence. Treatment involves steroids. Prednisolone is often used in combination with steroid-sparing drugs such as Azathioprine (Imuran). Oral lesions can be treated with applications of topical agents such as Triamcinolone (Kenalog) or Fluocinonide (Lidex). Higher potency topical treatments can be done with Dexamethasone (Decadron) or Clobetasol (Temovate). During severe episodes, prescribing systemic steroids, such as Prednisolone or Methylprednisolone possibly coupled with immunomodulators, such as Azathioprine, Cyclophosphamide, Tacrolimus, Dapsone, Cyclosporine, or Methotrexate may be considered in close collaboration with the patient's physician. Skin lesions with pemphigus are potentially life-threatening. Approximately 50% of patients with pemphigus present with oral lesions before the onset of skin lesions. Similar looking lesions can occur in patients with leukemia and lymphoma.

Pemphigoid is a defect in cell-mediated immunity resulting in damage to the epithelial basement membrane. This causes the epithelium to separate from the underlying connective tissue (subepithelial blister formation). Visually you will see blisters which rupture and cause desquamation and ulceration. Any oral mucosa site can be affected. Gingival lesions are most common and produce desquamative gingivitis. Occurs with greatest frequency in middle-aged women. Commonly associated with severe pain. Incisional biopsy should be performed with half of the tissue placed in formalin for routine histopathologic examination and half in Michel's solution for direct immunofluorescent studies. Direct immunofluorescent studies may be necessary to differentiate pemphigoid from erosive lichen planus and pemphigus. Direct immunofluorescence reveals deposits of IgG and complement C3 along the epithelial basement membrane zone. Treatment may require mild steroid applications including Triamcinolone (Kenalog) or Fluocinonide (Lidex ointment). Higher potency topical treatments can be done with Dexamethasone (Decadron) or Clobetasol (Temovate). Systemic steroids, such as Prednisolone or Methylprednisolone (Medrol) may be indicated in collaboration with the patient's physician. During severe episodes, prescribing systemic steroids, such as Prednisolone or Methylprednisolone possibly coupled with immunomodulators, such as Azathioprine, Cyclophosphamide, Tacrolimus, Dapsone, Cyclosporine, or Methotrexate may be considered in close collaboration with the patient's physician. Periodic biopsy for any malignant changes is appropriate. Re-evaluate as symptoms change, but at least at each recall. Other possible sites of involvement include conjunctiva, larynx, vaginal mucosa in women and skin (uncommon). Conjunctival scarring associated with cicatricial pemphigoid can lead to blindness.

References:

Lexi-Comp's Oral Soft Tissue Diseases. 3rd Edition. pgs. 76-79.

Regezi & Sciubba Oral Pathology Clinical-Pathologic Correlations. 1989. pg. 19.

Which of the following statements are true concerning half-life and clearance of

local anesthetic solutions?

- a. 4 half-lives will result in a reduction of a medication's concentration in the body by 94%.**
 - b. The kidneys are the primary excretory organ for local anesthetic solutions.**
 - c. If a patient has a significant renal impairment local anesthetic levels in the blood will be decreased.**
 - d. Bupivacaine has a half-life of 90 minutes.**
- i. b only**
 - ii. a, b**
 - iii. b, d**
 - iv. b, c, d**
 - v. All of the above**

Answer: ii

The blood level of local anesthetics is influenced by the following factors:

1. The rate at which the drug is absorbed into the cardiovascular system.
2. The rate of distribution of the agent from the vascular compartment to the tissues (more rapid in healthy patients than in those who are medically compromised, thus leading to lower and safer blood levels in healthier patients).
3. Elimination of the drug through metabolic and/or excretory pathways.

The latter two factors act to decrease the level of local anesthetic in the blood.

The rate at which a local anesthetic is removed from the blood is described as the half-life of the drug. The half-life is defined as the time required for a 50% reduction in the blood level of the medication. Two half-lives will result in a 75% reduction, three half-lives a 87.5% reduction, four half-lives a 94% reduction and five half-lives a 98.5% reduction.

The following table shows half-lives of common anesthetic solutions:

Drug	Half-life (minutes)
Procaine (Novocaine) ester	2
Etidocaine (Duranest) amide	56
Bupivacaine (Marcaine) amide	76
Prilocaine (Citanest) amide	<90
Lidocaine (Xylocaine) amide	90
Mepivacaine (Polocaine) amide	90
Articaine (Septocaine) amide	120

Excretion is primarily by way of the kidneys for both local anesthetic agents and their metabolites. A percentage of a given dose of local anesthetic will be excreted unchanged in the urine. Esthers appear in only very small concentrations as the parent compound in urine because they are hydrolyzed almost completely in the plasma. Amides are usually present in the urine as the parent compound in a greater percentage than esters because of their more complex processes of biotransformation. Patients with significant renal impairment may unable to remove from their blood the parent local anesthetic compound or its major metabolites, resulting in slightly elevated local anesthetic levels in the blood and an increased potential for toxicity. This may occur with either the esthers or the amides and is especially likely with cocaine. Thus renal disease is a relative contraindication to the administration of local anesthetic agents. This includes patients undergoing renal dialysis and those with chronic glomerulonephritis and/or pyelonephritis.

Reference: Stanley F. Malamed. Handbook of Local Anesthesia. 3rd Edition. Pgs. 27, 30.

Indications for incisional biopsy include all of the following, except?

- a. Large lesions that would require a complex excision and significant pre-planning.**
- b. A large brown pigmented lesion, suspected of being a malignant melanoma.**
- c. Lesions in which the differential diagnosis is necessary before initiating definitive treatment.**
- d. Obviously aggressive or malignant lesions where major surgical resection will be required and the biopsy is only necessary to verify the diagnosis.**

Answer: b

Incisional biopsy is where only a portion of the pathologic tissue is removed for microscopic examination. Indications include: 1) large lesions that would require significant surgical pre-planning for complex excision, 2) lesions in which the differential diagnosis includes entities with a diversity of treatment considerations and precise diagnosis is necessary before initiating definitive treatment, and 3) obviously aggressive or malignant lesions where major surgical resection will be required and the biopsy is only necessary to verify the diagnosis.

Methods include punch biopsy, shave biopsy and wedge biopsy. Choice of technique is dependent on operator preference and skill level and the particular lesion being biopsied. Wedges are preferred by pathologists.

Precautions for incisional biopsy include vascular lesions which could lead to difficult hemorrhage control if incised. Also, vital or critical anatomic structures adjacent to the intended incisional site. If malignant melanoma is suspected sampling by incisional biopsy is not recommended because you could increase the possibility of metastatic spread of the disease. Referral to an oral surgeon is recommended in this case.

Reference: Text – Contemporary Oral and Maxillofacial Surgery. 3rd Edition. 1998. Pgs. 520-21.

Text – Oral Pathology Clinical-Pathologic Correlations. 2nd Edition. 1993. Pgs. 142, 170-171.

Match each of the following pathologic conditions with its tendency to be a benign or a malignant lesion:

- | | |
|-----------------------------|--------------|
| ___ 1. Noma | a. Malignant |
| ___ 2. Kaposi's sarcoma | b. Benign |
| ___ 3. Keratoacanthoma | |
| ___ 4. Mesenchymal neoplasm | |
| ___ 5. Plasma cell myeloma | |

Answer:

- | | |
|-------------------------------------|--------------|
| <u>b</u> 1. Noma | a. Malignant |
| <u>a</u> 2. Kaposi's sarcoma | b. Benign |
| <u>b</u> 3. Keratoacanthoma | |

b 4. Mesenchymal neoplasm

a 5. Plasma cell myeloma

Noma is a necrotic, non-healing ulcer of the gingiva or buccal mucosa. It is rare and affects children. It is caused by anaerobes (fusiform bacilli and Vincent's spirochetes) in a patient with compromised systemic health. Treatment involves administration of antibiotics and improved systemic health. It is often associated with malnutrition and it may result in severe tissue destruction.

Kaposi's sarcoma is a malignant neoplasm of capillaries usually associated with AIDS. It often appears on the extremities, but can be found intraorally, especially on the palate. It appears as a reddish-brown or red to blue nodule. It is a rare lesion. The etiology appears to be from Human Herpes Virus 8 (HHV 8). Different forms include **Classic** which is found in Mediterranean males on the lower extremities, **African endemic** and **immunocompromised**. Clinical presentation is identical in all forms. Treatment is surgery, radiation or chemotherapy. The prognosis is good except when it is associated with AIDS.

FEATURES OF KAPOSI'S SARCOMA			
Parameter	Classic Type	African Type	Immunodeficiency Type
Geography	Mediterranean basin	Africa	Metropolitan areas
Prevalence	Rare	Endemic	Relatively common
Age	Older men	Children & adults	Adults
Skin lesions	Lower extremities	Extremities	Any site
Oral lesions	Rare	Rare	Common
Other organs	Occasionally	Occasionally	Frequently
Course	Indolent	Prolonged	Aggressive
Prognosis	Fair	Fair	Poor

Keratoacanthoma is a benign, well-circumscribed, firm, elevated lesion with a central keratin plug. It may cause pain and develops rapidly over 4 to 8 weeks and involutes in 6 to 8 weeks. It is found on sun-exposed skin and lips. They are rare intraorally and they have a predilection for males. The cause is unknown. Treatment is by surgical excision or observation. It is difficult to distinguish from squamous cell carcinoma clinically and microscopically. It may heal with a scar. Clinically it appears as a small red macule that develops into a firm papule with a fine scale over its highest point.

Mesenchymal neoplasm is a broad term encompassing several different connective tissue lesions. They are benign tumors. They appear as firm, asymptomatic tumescence covered by intact epithelium. They may arise from connective tissue from any cell. The cause is unknown. Treatment is by excision and recurrences are not expected.

Malignancies are rare. Examples include: Pyogenic granuloma, traumatic fibroma, myxoma, schwannoma, lipoma.

Plasma cell myeloma is a malignant non-odontogenic neoplasm of the jaw. It is a metastatic lesion that appears intraorally. It is found in adults with the mandible being the favored site. Radiographically it is a ill-defined, destructive lucency that may or may not be multilocular. It may have opaque foci. It is associated with pain or paresthesia often. The origin is most likely from a malignancy of the breast, kidney, lung, colon, prostate or thyroid. They are uncommon to rare.

Reference: Regezi & Sciubba. Oral Pathology Clinical-Pathological Correlations. 1989. pgs. O-13, O-33, O-47, O-55, O-99, 41-42, 137-138, 175-177, 184-223, 421-423.

Which of the following are contraindications to use of Lidocaine?

- a) documented allergy to esters
- b) documented allergy to amides
- c) Methemoglobinemia
- d) Significant cardiovascular disease (ASA III-IV) is an absolute contraindication
- e) Significant liver dysfunction (ASA III-IV)

- 1) a, c, e
- 2) b, c, d, e
- 3) b, e
- 4) All of the above

Answer: 3

Lidocaine

Classification: **amide**

Metabolism: in the **Liver**

Excretion: Kidneys

PKa =7.9

pH of vasoconstrictor soln. =5- 5.5

onset of action = 2-3 min.

half life= 90 min

Pregnancy **classification: B**

Maximum recommended dose for Lidocaine:

Manufacturer's:

Lidocaine + vasoconstrictor:

Adult and children: **3.2 mg/lb or 70 mg/kg not exceed 500mg**

Lidocaine without vasoconstrictor:

2.0 mg/lb not to exceed 300mg

Council on Dental therapeutics of the ADA and USP convention

2.0 mg/lb (4.4 mg/Kg)

Epinephrine-Sensitive patients (CV compromised, hyperthyroid):
40 µg /appointment = 1 cartridge 1/50,000
or 2 cartridges 1/100,000

Contraindications:

Hx. Of allergy to lidocaine, amide type local anesthetics, significant liver dysfunction, significant renal dysfunction

Mechanism of action:

Alfa stimulating effects cause a decrease in perfusion (decrease in blood flow) causing hemostasis

Vasoconstrictors act directly at the site of administration: absorbed slowly remain longer close to the nerve ↑duration ↑

Toxicity signs: drowsiness, loss of consciousness, respiratory arrest, CNS stimulation

table 4-2 **Contraindications for local anesthetics**

Medical problem	Drugs to avoid	Type of contraindication	Alternative drug
Local anesthetic Allergy documented	All local anesthetics in the same class	absolute	Local anesthetics in different chemical class
Atypical plasma cholinesterase	Esters	relative	Amides
Methemoglobinemia, idiopathic or congenital	Prilocaine	relative	Other amides or esters
Significant liver dysfunction (ASA III-IV)	Amides	Relative	Amides or esters, but judiciously
Significant renal dysfunction (ASA III-IV)	Amides or esters	Relative	Amides or esters, but judiciously
Significant cardiovascular disease (ASA III-IV)	High concentrations of vasoconstrictors (as in racemic epinephrine gingival retraction cords)	Relative	Local anesthetics with epi concentrations of 1/200,000 or 1/100,000 or mepivacaine 3% or prilocaine 4% nerve blocks
Clinical Hyperthyroidism	High concentrations of	Relative	Local anesthetics with epi

(ASA II-IV)	vasoconstrictors (as in racemic epinephrine gingival retraction cords)		concentrations of 1/200,000 or 1/100,000 or mepivacaine 3% or prilocaine 4% nerve blocks
--------------------	--	--	--

Esters	Amides
Procaine	Lidocaine
Propoxycaine	Etidocaine
Tetracaine	Mepivacaine
Cocaine	Bupivacaine
Benzocaine	Prilocaine
Dyclonine	Articaine

Ref: Handbook of Local Anesthesia by Malamed, 5th Ed. Chapters: 12, 13, 14 p.61-65, p.400

Meds causing gingival overgrowth:

Which of the following are true about meds causing gingival enlargement?

- a) Dilantin can cause gingival overgrowth
- b) Calcium channel blockers can cause gingival overgrowth
- c) Cyclosporines can cause gingival overgrowth
- d) Blood dyscrasias and hereditary fibromatosis should be ruled out
- e) All of the above

Answer: E

Meds causing gingival overgrowth:

Dilantin, calcium channel blockers (nifedipine and others), and cyclosporines.

Blood dyscrasias and hereditary fibromatosis should be rule out.

Specific drugs tend to deplete serum folic acid levels, this results in compromised tissue integrity.

Malamed. Handbook of local anesthesia. 5th Ed. p. 585- 586

Lesions likely to be premalignant:

Match:

- | | |
|--|---|
| a) Leukoplakia | 1) Histopathologically normal mucosa undergo a cellular transformation through various forms of dysplasia into verrucous hyperplasia, then into verrucous carcinoma, and finally invasive squamous cell carcinoma |
| b) Verrucous hyperplasia | 2) Sun induced premalignant lesion (not found on the upper lip). |
| c) Proliferative verrucous leukoplakia (PVL) | 3) can evolve into verrucous carcinoma |
| d) Erythroleukoplakia | 4) in earlier stages will appear as benign hyperkeratosis, lichen planus or hypertrophic candidiasis |
| e) Actinic Keratosis | 5) Mixed red-white patch |
| f) Keratoacanthoma | 6) Diff Dx: white asymptomatic lesions that do not rub off such as lichen planus, white sponge nevus, carcinoma, hyperkeratosis, hypertrophy form of candidiasis |
| | 7) At the first examination 5 % are found to be carcinomas |
| | 8) Sun related elevated mass with a central crater of brown or black keratin |

Answer: a)6, 7 b)3 c)1, 4 d)5 e)2 f)8

Pre-malignant Lesions:

White patch- Leukoplakia

White patch with red dots- stippled leukoplakia

Mixed red-white patch- erythroleukoplakia

White asymptomatic lesions that do not rub off: lichen planus, white sponge nevus, carcinoma, hyperkeratosis, hypertrophy form of candidiasis.

Leukoplakia (white) and erythroleukoplakia (red-white) diff dx: verrucous carcinoma, carcinoma in situ, squamous cell carcinoma proliferative verrucous leukoplakia.

At the first examination 5 % leukoplakias are found to be carcinomas, another 5% evolve into carcinomas.

At the first examination 25 % of erythroplakias are found to be dysplasia or invasive carcinomas and another 30% will become carcinomas.

Stippled leukoplakia and erythroleukoplakia are believed to have a greater malignant potential.

Nearly all require biopsy, excisional biopsy is better, multiple biopsies frequently necessary.

Verrucous hyperplasia → verrucous carcinoma (malignant form)

Proliferative verrucous leukoplakia- clinically normal-appearing oral mucosa slowly transforms through advancing stages of clinical leukoplakia, verrucous hyperplasia, and verrucous carcinoma, and then into invasive squamous cell carcinoma.

Histopathologically normal mucosa is observed to undergo a cellular transformation through various forms of dysplasia into verrucous hyperplasia, then into verrucous carcinoma, and finally into various differentiated patterns of invasive squamous cell carcinoma.

The lesions will strongly mimic benign hyperkeratosis, lichen planus or hypertrophic candidiasis. Eventually, untreated cases will develop induration and / or ulceration indicative of the final transformation into invasive carcinoma.

Lesions could be white, irregular, asymptomatic surface lesions, appearing either singly or in a small cluster.

The earlier stages of PVL will appear as benign hyperkeratosis, lichen planus or hypertrophic candidiasis. Biopsies of these early lesions are often misdiagnosed as one of these. The clinician should be alert to the possibility of PVL should the lesions spread out or fail to respond to treatment regimens aimed at either lichen planus or candidiasis.

Treatment / Biopsy

Since candidiasis is part of the differential diagnosis and may be seen along with PVL, a periodic acid-Schiff (PAS) stain may be requested. In addition, since PVL-related squamous cell carcinoma or one that is unrelated to PVL may be diagnosed, a complete head and neck examination and a TNM classification are recommended.

Submucous fibrosis will usually present as a limited jaw opening (trismus).

The diagnosis is made from a history of repetitive exposure to betel nut or a similar substance, the clinical appearance and the texture of the tissue.

The characteristic change is within the connective tissue, where very dense avascular collagenous tissue is deposited. Adjacent skeletal muscles may atrophy. There are also epithelial changes ranging from atrophy with hyperkeratosis

Premalignant conditions of the skin.

Actinic Keratosis

Sun induced premalignant lesion (not found on the upper lip).

Histologically dysplastic

Early lesions will present as atrophic, indurated red plaques

Differential Diagnosis:

Early basal cell carcinoma

Nevi

Melanoma Actinic Cheilitis



Actinic Keratosis

Keratoacanthoma

Sun related

Elevated mass with a central crater of brown or black keratin

Adjacent skin will often show 1-2mm band of erythema

Most are isolated lesions

Differential Diagnosis:

Skin Squamous cell carcinoma

Basal cell carcinoma

Melanoma

Treatment: Excision



Keratoacanthoma

Marx, Stern. Oral and Maxillofacial pathology A rationale for diagnosis and treatment. Quintessence. 2003. p309-359

Salivary gland infections

Match:

- | | |
|-------------------------------------|--|
| 1) HIV parotitis | a) A paramyxovirus infection. |
| 2) Mumps | b) usually bilateral, due to multiple lymphoepithelial cysts in the parotid glands. |
| 3) Submandibular Gland Sialadenitis | c) Staphylococcus aureus usually MRSA (methicillin resistant strain). |
| 4) Bacterial Parotitis | d) May occur in association with Sialolithiasis, tumor or direct bacterial infection |

Answer:

- 1) b
- 2) a
- 3) d
- 4) c

Salivary Gland Infections: type, how, tx

Mumps

Most common salivary gland disease, a **paramyxovirus** infection, usually bilateral in the parotid (75% of cases), to some extent submandibular and sublingual glands, usually not immunized child, more severe involvement with adults, transmission via saliva droplets 14-21 day incubation.

Symptoms: low grade fever and malaise. 2 weeks duration. Sometimes involvement of other organs, the most severe complication is meningitis.

Diff Dx: bacterial Parotitis, viral Parotitis (coxsackie A virus, cytomegalovirus, echovirus, and parainfluenza viruses), obstructive Parotitis. Other not associated with tenderness and fever): Sjogren syndrome, Sialosis, Lymphomas, sarcoidosis, bulimia,

Dx: isolation of paramyxovirus from saliva, or serum with fourfold mumps antibody titers. Lymphocytosis, WBC normal. Serum amylase increased.

Tx: supportive care, bed rest, hydration, analgesics, antipyretics

Vaccine as part of MMR (mumps-measles-rubella).

Bacterial parotitis:

Childhood recurrent form (related to predisposing factors) and adult form with advancing age secondary to dehydration, debilitation, decreased parotid flow

secondary to parasympathologic drugs (atropine, propantheline bromide, etc.), mucous plugs, Sjogren syndrome.

Symptoms: swollen and painful gland, especially when eating due to salivary distension, fever, opening of Stensen duct erythematous, pus. **Staphylococcus aureus usually MRSA (methicillin resistant strain).**

Less common than bacterial submandibular gland sialadenitis.

Dx: culture and sensitivity of the exudate. Sialography.

Tx: Hydration, IVs, antibiotics

Prognosis: good

Sialosis

Bilateral diffuse enlargement of both parotid glands. Most cases are painless.

Two types: 1) **Idiopathic-bulimic or RSD related sialosis (20-40y/0)** – enlarged parotid glands caused by acinar cell hypertrophy
2) **Related to nutritional imbalances (50 y/o or more)** such as diabetes, cirrhosis, alcoholism and chronic obesity – it causes enlargement due to fatty infiltration into the gland

Diff Dx: Sjogren syndrome, lymphomas, benign lymphoepithelial lesion

DX: incisional parotid biopsy

Tx: behavioral modification, sometimes antidepressants,

Benign Lymphoepithelial Lesion (BLEL)

It occurs in adults of either sex, it is like a Sjogren infiltration without the sicca syndrome and without rheumatoid manifestations.

Both parotid glands become involved in nearly all cases. Lymphoepithelial lesions may include a single lymphoepithelial cyst.

Diff Dx : Lymphomas caused by BLEL, Sarcoidosis, nutritional sialosis, HIV Parotitis and mumps.

Tx. No tx. Only 5-10% progress to lymphoma (radiotherapy 5,000cGy to 6,800cGy).

Sjogren Syndrome

Lymphocytic infiltration of exocrine glands (primarily salivary and lacrimal glands)

Pathogenesis: age related or viral related alterations of surface antigens on the acinar cells of the gland.

Submandibular Gland Sialadenitis

May occur in association with Sialolithiasis, tumor or direct bacterial infection.

Swelling, tenderness, and pain, During the acute phase: fever, leukocytosis, and pain. Organisms: Penicillin-resistant S aureus (often methicillin-resistant) and streptococci species that are associated with bacterial Parotitis.

Diff dx: Sialolithiasis, salivary gland tumor, odontogenic infection.
Tx: culture the exudate, empiric antibiotics: Augmentin 875mg twice a day, dicloxacillin 500mg 4 times daily, erythromycin 400mg 4 times a day. Hydration, sialogogues.
Panoramic, occlusal radiograph, CT or MRI.
For refractory cases: surgical excision of the gland.
10% of the cases are related to a tumor. Malignant cases require additional surgery, neck dissection, and radiotherapy.

HIV Parotitis

Occurs in 3% of HIV patients, **usually bilateral, due to multiple lymphoepithelial cysts in the parotid glands.**

Diff Dx in HIV patient.: Lymphomas in the parotid gland, TB Parotitis, TB adenitis, Kaposi Sarcoma, Sarcoidosis

Diff Dx if HIV is unknown: Sjogren syndrome, Sialosis, Lymphoma of the parotid, Benign Lymphoepithelial Lesion,

Dx: CT scan, incisional parotid biopsy if no defined mass can be seen in the CT, incisional parotidectomy if defined mass can be seen in the CT

Tx: Surgery is the tx of choice, superficial parotidectomy (effective correcting the enlargement and reducing the pain) and radiotherapy (2,000 cGy to 4,000 cGy).

Recurrence uncommon.

Reference:

Marx, Stern. Oral and Maxillofacial pathology A rationale for diagnosis and treatment. Quintessence. 2003. p 497-526

Which of the followings is/are true about mitral valve prolapse (MVP)?

- A) Based on the new AHA guidelines a patient with MVP with regurgitations needs to be premedicated before invasive dental procedures
- B) Narrowing of the orifice of the mitral valve of the heart
- C) Mitral valve does not close properly and allows blood backflow into the left atrium
- D) The Lifetime Risk of acquiring IE (infective endocarditis) when MVP with regurgitation is present is 2160 per 100,000 patient-years.
- E) Accounts for 25% to 30% of cases of adults with Native Valve endocarditis (NVE)

- 1) B
- 2) C
- 3) C,E
- 4) A,B,C
- 5) all of the above

Answer: 3

MVP

Mitral Valve prolapse:

accounts for 25% to 30% of cases of adults with Native Valve endocarditis (NVE) most common underlying condition among patients who develop Infective Endocarditis (IE).

Aortic valve disease (stenosis or regurgitation or both) accounts for 12-30% NVE cases

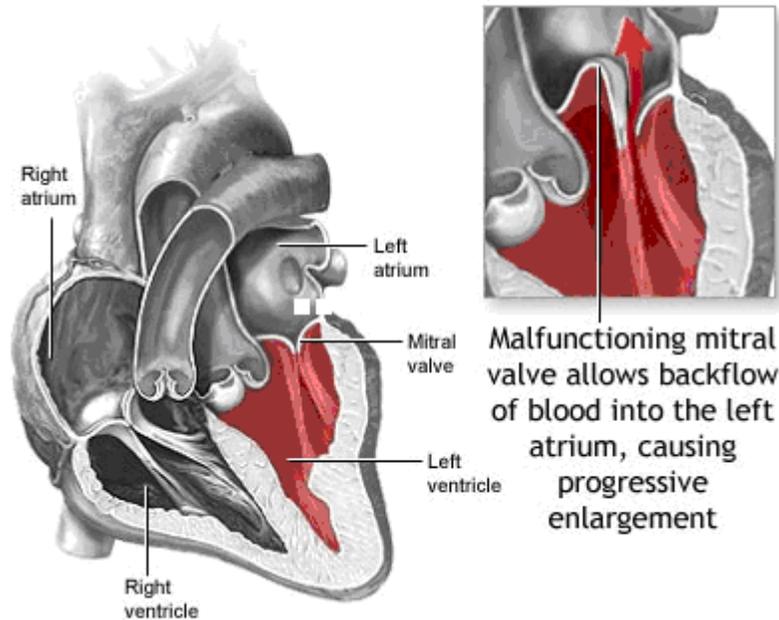
Prosthetic valve endocarditis (PVE) is an endovascular, microbial infection occurring on parts of a valve prosthesis or on reconstructed **native heart valves**. The microbiology of PVE is very different from that of native valve endocarditis (NVE). Streptococci and enterococci occur less frequently, while staphylococci, bacteria of the HACEK group (*Haemophilus*, *Actinobacillus*, *Cardiobacterium*, *Eikenella*, and *Kingella*), and fungi are found more frequently in cases of PVE. Novobiocin susceptible, coagulase negative staphylococci have a particularly high affinity for implanted or indwelling foreign surfaces, especially polymers. They are the most frequent pathogens causing PVE.

Downloaded from heart.bmj.com ; *Heart* 2001;**85**:590–593

Lifetime Risk of acquiring IE	
Predisposing condition	No. of patients/ 100,000 Patients-years
Gen. population	5
MVP without audible cardiac murmur	4.6
MVP with cardiac murmur of mitral regurgitation	52
RHD (Rheumatic heart disease)	380-440
Mechanical bioprosthetic valve	308-383
Cardiac valve replacement surgery for native valve	630
Previous endocarditis	740
Prosthetic valve replacement in patients with PVE (prosthetic valve endocarditis)	2160

Falace et al. Medical management of the medically compromised patient. 2008. Mosby. P. 18-33.

Mitral valve prolapse is a disorder in which, during the contraction phase of the heart, the mitral valve does not close properly. When the valve does not close properly it allows blood to backflow into the left atrium. Some symptoms can include palpitations, chest pain, difficulty breathing after exertion, fatigue, cough, and shortness of breath while



lying down.

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<http://www.nlm.nih.gov/medlineplus/ency/imagepages/18148.htm>

Which of the following are true concerning Eagle syndrome?

- Most commonly affects children.
- Panorex or lateral-jaw radiographs are useful in diagnosis.
- Can occur following trauma or surgery
- Can cause pain upon turning the head
- Prognosis in severe cases is poor with formation of blood clots common

a,c,e

c,d,e
b,c,d
b,d,e
b,c,d,e
a,b,c,d

Answer: b,c,d

Eagle syndrome (stylohyoid syndrome, carotid artery syndrome) occurs from elongation of the styloid process or mineralization of the stylohyoid ligament. This ligament connects the styloid process that originates from the inferior aspect of the temporal bone and with the lesser cornu of the hyoid bone. The external and internal carotid arteries lie on either side. When the ligament becomes calcified, it can impinge upon the adjacent nerves or blood vessels. Surgeries such as tonsillectomies can cause development of a scar in the area of the stylohyoid complex and can lead to pain in the region of cranial nerves V, VII, IX, and X, especially during swallowing. This syndrome develops most commonly in adults. Patients often experience vague pain, dysphagia, dysphonia, otalgia, headache, dizziness and syncope. In mild cases, no treatment is necessary. In more severe cases, surgical excision of the styloid process or ligament is required. The prognosis is good...

Nevills and Damm Oral and Maxillofacial Pathology, 2nd ed., Copyright 2002 W.B. Saunders Company ISBN 0-7216-9003-3 p. 22-23.

INR refers to International Normalized Ratio. INR is determined by dividing the patient's PTT by the mean normal PTT for the laboratory, determined by using the International Sensitivity Index (ISI) to adjust for the lab's reagents. For most dental procedures, an INR of 1.5 to 2.5 or less indicate that the procedure can be done safely.

- a. The first statement is true, the second false, and the third true
- b. The first statement is false, the second false, and the third true
- c. All are false
- d. All are true
- e. The first statement is true, the second and third are false.
- f. The first and second statements are true, the third is false
- g. Make up your own combination not of the above

Answer: a. True, false and true...

INR, or International Normalized Ratio, refers to the standardization of PT, or prothrombin time. This is used to evaluate coumadin response on the coagulation within patients by way of the vitamin K-dependent clotting mechanism. Because of a wide range in reaction to the reagents used, the International Sensitivity Index was developed to adjust for this variation. The response to oral anticoagulants can vary greatly in patients, and regular monitoring is warranted, with a current evaluation close to the surgery date (the morning of or the day before...)

PTT refers to partial thromboplastin time, which is used along with bleeding time as measures for platelet dysfunction. Aspirin and plavix are antiplatelet drugs whereas coumadin is an anticoagulant. Aspirin works by inhibiting cyclo-oxygenase which is involved in the platelet clot formation system. Wynn et al, Drug Information Handbook for Dentistry, 13th ed., P. 1732-1733 Copyright 2007 by Lexicomp co., ISBN 978-1-59195-217-6.

Which of the following concerning Necrotizing Sialometaplasia are true?

- a. Is an uncommon, locally aggressive malignancy.
- b. Can occur from ischemia of the salivary tissue leading to local infarction.
- c. More than 75% of the cases occur in the soft palate.
- d. Biopsy is not indicated prior to definitive diagnosis.
- e. The lesion typically resolves on its own accord within 5-6 weeks.

Answer: b and e.

Necrotizing Sialometaplasia is a locally destructive inflammatory condition of the salivary glands. The cause is uncertain, but most authors believe it is the result of ischemia of the salivary tissue which leads to infarction. However, this mimics a malignant process, both clinically and microscopically. The condition initiates as a nonulcerated swelling sometimes associated with pain or paresthesia. In 2-3 weeks, necrotic tissue sloughs, leaving a craterlike ulcer that can range up to 5 cm in diameter. Microscopically, acinar necrosis occurs in early lesions. Next, associated squamous metaplasia of the salivary ducts occurs. However, the overall lobular architecture of the involved glands is still preserved. The squamous metaplasia of the salivary ducts can produce a pattern that is similar to squamous cell carcinoma or mucoepidermoid carcinoma. Biopsy is indicated because of the possibility of malignant disease; however, once the diagnosis has been made, the lesion can be allowed to resolve. A number of predisposing factors have been implicated, including traumatic injuries, dental injections, ill-fitting dentures, upper respiratory infections, ADJACENT TUMORS and previous surgery, any of which can compromise blood flow to the involved glands resulting in necrosis.

Neville and Damm Oral and Maxillofacial Pathology, 2nd ed., Copyright 2002 W.B. Saunders Company ISBN 0-7216-9003-3 p. 405-406.

Oral presentations of leukemia can involve which of the following? Pick all that apply.

- a. Easy bruising and bleeding
- b. Petechial hemorrhages of the posterior hard palate and soft palate
- c. Spontaneous gingival hemorrhage
- d. Ulceration of the oral mucosa
- e. Herpetic infections
- f. Diffuse, boggy, non-tender swelling and gingival enlargement

Answer:

All. Leukemia represents several types of malignancies of hematopoietic stem cell derivation. The disease begins with the malignant transformation of one of the stem cells, which initially proliferates in the bone marrow and then overflows into the peripheral blood. The leukemic cells eventually crowd out the normal defense cell and erythrocyte precursors, leading to the loss of function of these cells.

Certain genetic and environmental factors can predispose patients including, including Down and Bloom syndrome, neurofibromatosis, schwachman syndrome, ataxia-telangiectasia syndrome, Klinefelter syndrome, Fanconi's anemia and Wiskott-Aldrich syndrome. Some chromosomal abnormalities have been noted with the Philadelphia chromosome, a translocation of the chromosomal material between the arms of chromosomes 22 and 9. This can activate a specific oncogene, resulting in the uncontrolled proliferation of the leukemic cell. Ionizing radiation and viruses have also been shown to produce leukemia, the most common one being HTLV-1. or Human T-cell leukemia/lymphoma virus type I.

Leukemias are classified according to their behavior and to their histogenesis. Broad categories would be acute or chronic referring to their course and myeloid or lymphocytic/lymphoblastic referring to the histogenic origin. Myeloid leukemias can differentiate along several different pathways, producing malignant cells that show features of granulocytes or monocytes usually, with rare examples of erythrocytes or megakaryocytes being produced. Acute myeloid leukemia affects a broad age range, including children. Chronic myeloid leukemia peaks during the third and fourth decades. Acute lymphoblastic leukemia almost always occurs in children. Chronic lymphocytic leukemia is the most common type of leukemia and affects mostly elderly adults.

Early signs and symptoms of leukemia are related to the reduction in numbers of normal cells as the normal hematopoietic stem cells are crowded out by the malignant proliferation. Reduced red blood cell count causes a reduction in oxygen-carrying capacity. Malignant cells can infiltrate other organs and cause splenomegaly, hepatomegaly and lymphadenopathy. Lack of blood platelets (thrombocytopenia) results from megakaryocytes being crowded out, leading to Petechial hemorrhages. Patients also become susceptible to infections as the white blood cell production drops, with the first signs sometimes being fever associated with an infection. Ulceration of the oral mucosa can result from the host's loss of ability to fight infection, with the most common ulcerations occurring in areas of high bacterial counts such as the gingival. The leukemic cells can occasionally infiltrate the oral soft tissues, which can create a diffuse, boggy nontender swelling with or without ulcerations. Infiltration of periapical tissues can simulate periapical inflammatory disease, both clinically and radiographically.

Neville and Damm Oral and Maxillofacial Pathology, 2nd ed., Copyright 2002 W.B. Saunders Company ISBN 0-7216-9003-3 p. 510-512.

HPV is a large family of double-stranded DNA viruses of the papovavirus subgroup A and causes papillomas. Epstein-Barr virus (EBV or HHV-4) is a member of the human herpesvirus officially known as Herpesviridae, a DNA virus that causes infectious mononucleosis and has been implicated in lesions of oral hairy leukoplakia, a variety of lymphomas, nasopharyngeal carcinoma and even some gastric carcinomas and smooth muscle tumors.

- a. Both statement groups are true
- b. Both statement groups are false
- c. The first is true, the second false
- d. The first is false, the second true
- e. Parts but not all of both are true

Answer: Both statement groups are true.

Squamous papilloma is a benign proliferation of stratified squamous epithelium that results in a papillary mass. This lesion is usually induced by the human papillomavirus (HPV). The virus is capable of becoming totally intergrated with the DNA of the host cell. Sites can include any oral soft tissue surface, with the most common being the tongue, lips and palate. Projections can be pointed or blunted on a soft, painless pedunculated nodule. The color may be white, slightly red or normal. Usually, the lesion enlarges to a maximum size of about 0.5 cm. Verucca vulgaris is a benign, virus-induced focal hyperplasia of stratified squamous epithelium. It is contagious and can spread to other parts of a person's skin or mucous membranes via auto-inoculation. Condyloma acuminatum is a venereal wart caused by a virus induced induction of squamous epithelium in the perianal region, mouth and larynx. One or more of types 2,6,11,53 and 54 usually are detected in the lesion. However, high-risk types 16

and 18 are also found with frequency, especially in anogenital lesions. Condyloma is considered to be a sexually transmitted disease, and may be an indicator of sexual abuse when diagnosed in young children.

Epstein-Barr virus (EBV or HHV-4) is a member of the human herpesvirus or herpetoviridae. Humans are the only natural reservoir, and all HHVs have the ability to reside for life within the host. After initial infection, periods of latency and reactivation with viral shedding occur. EBV or HHV-4 usually occurs by intimate contact, with intrafamilial spread common. Children usually become infected through contaminated saliva while adults usually contract the virus through direct salivary transfer. Symptoms worsen with age, however, significant complications involving splenic rupture, thrombocytopenia, autoimmune hemolytic anemia and neurologic problems with seizures, while uncommon at any age, do develop more frequently in children. The classic infectious progress begins with prodromal fatigue, malaise and anorexia for up to 2 weeks before fever development, which may reach 104 degrees F and can last 2-14 days. Oropharyngeal tonsillar enlargement can occur which may involve diffuse exudates and abscesses and rarely death due to airway obstruction. Other diseases implicated but not proven are oral hairy leukoplakia, lymphomas such as African Burkitt's and nasopharyngeal carcinoma, gastric carcinomas and occasional smooth muscle tumors. Also, a complex called chronic fatigue syndrome has been described, but several studies have cast doubt on a relationship between EBV and chronic fatigue syndrome.

Neville and Damm Oral and Maxillofacial Pathology, 2nd ed., Copyright 2002 W.B. Saunders Company ISBN 0-7216-9003-3 p. 224-226 and p. 316-319

If biochemical evaluation demonstrates inadequate HPA axis function or insufficient adrenal reserve in a patient with doubtful adrenal cortical status or if preoperative testing is not performed, perioperative glucocorticoid coverage should be provided according to which of the following?

- a. For minor surgical stress, the glucocorticoid target is 25 mg. hydrocortisone equivalent on the day of the surgery
- b. For moderate surgical stress, the target is about 50-75 mg per day of hydrocortisone equivalent for 1-2 days
- c. For major surgical stress, the glucocorticoid target is 100-150 mg per day of hydrocortisone equivalent for 2-3 days
- d. All of the above

Answer: d. All of the above

Surgery is known to cause increased plasma corticosteroid levels during and after operations. Plasma cortisol levels peak up to 10-fold above baseline between 4 and 10 hours after the operation. The level of the response is based on the magnitude of the surgery and whether general anesthesia is used. Postoperative pain is also contributory. Cortisol secretion in the first 24 hours following surgery rarely exceeds 200 mg. Under conditions of general anesthesia, corticosteroid-treated patients have a significantly lower plasma cortisol response to surgery than patients who have not received these drugs. However, several studies have shown that the vast majority of patients who take chronic daily equivalent or less doses of 5-10 mg prednisone daily of steroid are at less risk. However, a patient with a daily dose of 40 mg prednisone daily for several years should receive 40 mg prednisone or the parenteral equivalent preoperatively and 50 mg hydrocortisone I.V. every 8 hours after the initial dose for the first 48 to 72 hours after surgery, In comparison, a patient taking 5 mg. prednisone daily undergoing a similar major surgery is recommended to receive 5 mg prednisone or equivalent as a pre-op dose with 25 mg. hydrocortisone given intraoperatively and 25 mg administered in the 8 hours after surgery. Hydrocortisone 25 mg is prescribed every 8 hours for the subsequent 48 hours. The above protocol recommends that the steroid be taken within 2 hours of the surgery and the surgeon, anesthetist and nurses be advised of the possible complications. Factors that can complicate the postoperative course such as drug use or sepsis must be monitored and evaluated.

The following chart outlines various glucocorticoids and their equivalent dose, using 20 mg of cortisol over a 24-hour period as the normal secretion rate of cortisol:

Glucocorticoids	Approximate Equivalent Dose (mg)
Short Acting (<12 hours)	
Cortisol	20 (normal daily secretion rate)
Cortisone	25
Intermediate-acting (12-36 hours)	
Prednisone	5
Prednisolone	5
Methylprednisolone	4
Triamcinolone	4
Long-acting (>36 hours)	
Paramethasone	2
Betamethasone	0.75
Dexamethasone	0.75

Which of the following drug regimens are appropriate therapy for tuberculosis?

- a. Isoniazid (INH) for nine months.
 - b. Isoniazid and rifampin for nine months.
 - c. Isoniazid, rifampin, and pyrazinamide for two months; followed by isoniazid and rifampin for four months.
 - d. Isoniazid, rifampin, pyrazinamide, and ethambutol or streptomycin for two months; followed by isoniazid and rifampin for four months.
-
- i. a and b.
 - ii. c and d.
 - iii. b, c and d.
 - iv. a, c and d.

Answer: iii. b, c and d.

Tuberculosis is a chronic infectious disease caused by *Mycobacterium tuberculosis* and is primarily spread through small droplets in the air. It is a major worldwide health problem with more than one billion people being infected, and 8 million new cases and 3 million deaths reported per year. Tuberculosis incidence declined in the United States after the widespread use of antimicrobials began in the 1940's, but the incidence leveled off in the 1980's due to an increased incidence of HIV and drug resistance.

When infection occurs, symptoms may develop (often in the lungs) and the patient develops primary tuberculosis. Symptoms include low-grade fever, malaise, anorexia, weight loss and night sweats; eventually a productive cough, hemoptysis and/or chest pain develop. Typically a nonspecific, chronic inflammatory reaction develops and results in a localized, fibrocalcified nodule in the lungs. The condition then goes latent. It may be reactivated later with patient immunocompromised and result in secondary tuberculosis. If the disease gains access to the vascular system and becomes widely disseminated, it is called miliary tuberculosis.

Oral lesions associated with tuberculosis are uncommon, but if present usually occur as a chronic painless ulcer. Cervical lymphadenopathy (+/- calcified nodes), orofacial fistulas, and tuberculosis-associated osteomyelitis have also been reported.

Histopathology of all lesions demonstrates a cell-mediated hypersensitivity reaction (type IV) with collections of epithelioid histiocytes, lymphocytes, and multinucleated giant cells.

Treatment of tuberculosis is very difficult and requires prolonged antimicrobial therapy because the organisms tend to collect within lesions. Drug resistance has also become a major problem; as a result, only multidrug combination regimens are recommended today.

Multidrug therapies include isoniazid and rifampin for nine months; or isoniazid, rifampin, and pyrazinamide for two months followed by isoniazid and rifampin for four months. In cases where drug resistance is suspected (common today), a four drug combination of isoniazid, rifampin, pyrazinamide, and ethambutol or streptomycin for two months; followed by isoniazid and rifampin for four months. The latter has now been established as the global standard regimen. If confirmed resistance is demonstrated, anywhere from three to seven antimicrobials may be employed. Newer fluoroquinolones (like moxifloxacin and gatifloxacin) have demonstrated efficacy as alternatives to traditional medications.

References:

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- Neville *et al.* *Oral and Maxillofacial Pathology,* 2nd Ed. W.B. Saunders Company. 2002.
- Wada M. Anti-tuberculosis chemotherapy. *Kekkaku.* 2007 Oct; 82(10): 771-781.

Which salivary gland duct is most often affected by sialolithiasis?

- a. Bartholin's duct.
- b. Ducts of Rivinus.
- c. Stenson's duct.
- d. Wharton's duct.

Answer: d. Wharton's duct.

Bartholin's duct and the ducts of Rivinus drain the sublingual gland and nearby minor salivary glands. Stenson's duct drains the parotid gland.

Wharton's duct drains the submandibular gland and is most often affected by sialolithiasis due to its long, tortuous and upward path and also because of the thicker, mucoid secretions of the submandibular gland relative to the parotid gland. Sialoliths may or may not appear on radiographs; they are best diagnosed using an occlusal film.

Symptoms include tenderness to palpation and exacerbation of symptoms around mealtime due to salivation of the patient. No age predilection has been noted. Treatment may include sialogogues, warm/moist heat and milking the duct. If unsuccessful, surgical intervention may be needed to remove the stone and/or the entire gland (in cases where glandular damage has occurred).

Reference: Neville *et al.* *Oral and Maxillofacial Pathology,* 2nd Ed. W.B. Saunders Company. 2002.

A Stafne defect, or lingual submandibular salivary gland depression, is a congenital lesion reported predominately in middle-aged and older adults. Once diagnosed, treatment is usually not indicated and the prognosis is excellent.

- a. Both statements are true.
- b. The first statement is true; the second statement is false.
- c. The first statement is false; the second statement is true.
- d. Both statements are false.

Answer: c. The first statement is false; the second statement is true.

A Stafne defect, or lingual submandibular salivary gland depression, is a developmental lesion reported predominately in middle-aged and older adults. Thus, it tends to develop over the lifetime of the patient. It is not a congenital lesion – or one present at birth. 80-90% of cases occur in men, with the incidence reported as high as 0.3% based on a study of panoramic radiographs.

Salivary gland depressions may be produced by any major salivary gland, but the large majority are associated with the submandibular gland. Biopsy tends to reveal normal salivary gland tissue, though some lesions have contained muscle, fibrous connective tissue, blood vessels, fat, lymphoid tissue, or been empty.

The lesion is located inferior to the inferior alveolar canal. Benign fibro-osseous lesions should be considered in the differential diagnosis (ossifying fibroma, focal cemento-osseous dysplasia).

Once diagnosed, treatment is typically not indicated. The prognosis is excellent.

Reference: Neville *et al.* *Oral and Maxillofacial Pathology*, 2nd Ed. W.B. Saunders Company. 2002.

Which of the following types of nevi occur in the mouth?

- a. Intradermal nevus.
 - b. Intramucosal nevus.
 - c. Blue nevus.
 - d. Congenital melanocytic nevus.
 - e. Nevus flammeus.
 - f. White sponge nevus.
-
- i. a, b, c, d and f.
 - ii. b, c and f.

- iii. b, c, d, e and f.
- iv. All of these.

Answer: iii. b, c, d, e and f.

Acquired melanocytic nevi are classified based on where the nevus cells are located. Initially, these cells are in the basal layer of epithelium near the junction with the connective tissue, they are called junctional nevi. Over time, the cells proliferate and start to invade the underlying dermis or lamina propria – when this happens, they are referred to as compound nevi because the nevus cells are located in epithelial and connective tissue. At later stages, all the nevus cells wind up in the connective tissue, at which point the lesion is called an intradermal nevus. The oral counterpart of this is the intramucosal nevus, so intradermal nevi are NOT found in the mouth. Intraoral nevi are believed to follow this same progression to maturity, though at the time of diagnosis, most lesions are in the intramucosal nevus stage.

Blue nevi are uncommon proliferations of dermal melanocytes. These cells are located deep within subepithelial connective tissue, and appear blue because of the Tyndall effect. This relates to the interaction of light with particles in a colloidal suspension; when light is reflected back off the nevus cells, colors with long wavelengths (red and yellow) tend to be absorbed by the tissue, while those with shorter wavelengths (blue and purple) pass through. Thus, even though the melanocytes produce a brown pigmentation, the lesion appears blue to the eye.

Congenital melanocytic nevi are present at birth, tend to be larger, and commonly exhibit hypertrichosis (excess hair). They may be found both on the skin and intraorally, though hypertrichosis is not as common intraorally.

Nevus flammeus is another name for port wine stain. It is seen intraorally in association with Sturge-Weber angiomatosis. This condition occurs due to a dermal capillary vascular malformation and presents unilaterally along one or more segments of the trigeminal nerve.

White sponge nevus is a rare, autosomal dominant skin condition that results in symmetric, thickened, white, plaques on the buccal mucosa. They will be present bilaterally and can have either a corrugated or velvety surface. Patients are usually asymptomatic. The condition is benign, requires no treatment, and has a good prognosis.

Reference: Neville *et al.* *Oral and Maxillofacial Pathology*, 2nd Ed. W.B. Saunders Company. 2002.

Which of the following is NOT associated with oral or perioral pigmentation?

- a. Peutz-Jeghers Syndrome.
- b. Addison's Disease.
- c. Tobacco smoking.
- d. Heavy metal poisoning.
- e. Cushing's Disease.

Answer: e. Cushing's Disease.

Peutz-Jeghers syndrome is a rare condition characterized by freckle-like lesions of the hands, perioral skin, and oral mucosa. Unlike true freckles, these lesions will not wax and wane with sun exposure. Patients with this condition also develop intestinal polyposis (but only 2-3% transform to adenocarcinoma), and are at increased risk of cancers that affect the male/female genital tract, breast, ovary and pancreas.

Addison's disease results when an adrenal corticosteroid insufficiency results from destruction of the adrenal cortex. This condition is also called primary hypoadrenocorticism. Clinical features include fatigue, irritability, depression, weakness, and hypertension. Generalized hyperpigmentation of the skin occurs because increased levels of beta-lipoprotein and ACTH stimulate melanocytes. Oral mucous membranes may also display hyperpigmentation, often before the skin, making this a clue toward diagnosis.

Tobacco smoking (especially cigarettes) has been associated with general melanoplakia, especially in women. Pipe smokers do not tend to exhibit this hyperpigmentation. The condition is worse in people who practice reverse smoking. Smoking cessation will lead to gradual fading of pigmentation over time.

Heavy metal ingestion/poisoning usually can be detected intraorally by a blue-gray color change in the attached gingiva. This has been noted when excess amounts of lead, mercury, silver and bismuth are ingested.

Cushing's disease is not associated with hyperpigmentation.

Reference: Neville *et al.* *Oral and Maxillofacial Pathology*, 2nd Ed. W.B. Saunders Company. 2002.

Which of the following do NOT affect the TMJ?

- a. Rheumatoid arthritis.
- b. Osteoarthritis.
- c. Hemarthrosis.
- d. Arthralgia.
- e. All of these can affect the TMJ.

Answer: e. All of these can affect the TMJ.

The TMJ is involved in up to 40% of patients with rheumatoid arthritis, however it tends to not become involved until late in the disease.

With osteoarthritis, stiffness of the joint is uncommon (unlike other joints), but tenderness of the muscles of mastication is common as they are constantly attempting to immobilize the painful joint.

Hemarthrosis occurs in the TMJ after trauma-induced hemorrhage. Fibrotic intra-articular ankylosis results afterward. Osseous ankylosis occurs after nonhemorrhagic infections of the joint.

Arthralgia is a term referring to joint pain.

Reference: Neville *et al.* *Oral and Maxillofacial Pathology*, 2nd Ed. W.B. Saunders Company. 2002.

PEDO/ORTHO/PUBLIC HEALTH/INFECTION CONTROL

Concerning the factors regulating and affecting the eruption of permanent teeth into the mouth, which of the following is/are USUALLY TRUE?

- a). Eruption occurs in the mandible before the maxilla
 - b). permanent incisors should erupt by age eight to nine
 - c). Mechanical disturbances can alter the genetic plan.
 - d). In general, girls erupt their permanent teeth earlier than boys.
- A. a
 B. a, b, and c
 C. a, b, and d
 D. all the above are true

Answer:
 4. all the above

It is less important to know the most common eruption sequences than it is to know the expected timing of these eruption stages. The time of eruption of both primary and permanent teeth varies greatly. According to Moyers, the most common sequence of the eruption of **permanent teeth in the mandible** is:

first molar, central incisor, lateral incisor, canine, first premolar, second premolar, and second molar.

The most common sequence for **eruption of the maxillary permanent teeth** is: first molar, central incisor, lateral incisor, first premolar, second premolar, canine and second molar.

The tables below readily show mandibular teeth erupt prior to maxillary teeth. Females mature earlier than males in most aspects, dental development being no exception.

Primary Dentition

Tooth	Calcification Begins	Enamel @ Birth	Enamel Completed	Eruption	Root Completed
MAXILLARY					
Central	4 mo in utero	5/6	18-24 mo	6-10 mo	1.5 yr
Lateral	4.5 mo in utero	2/3	18-24 mo	8-12 mo	2 yr
Cuspid	5 mo in utero	1/3	30-39 mo	16-20 mo	3.25 yr
1st Molar	5 mo in utero	Cusps united	24-30 mo	11-18 mo	2.5 yr
2 nd Molar	6 mo in utero	Cusps tips still isolated	36 mo	20-30 mo	3 yr
MANDIBULAR					
Central	4.5 mo in utero	3/5	18-24 mo	5-8 mo	1.5 yr
Lateral	4.5 mo in utero	3/5	18-24 mo	7-10 mo	1.5 yr
Cuspid	5 mo in utero	1/3	30-39 mo	16-20	3.25 yr

				mo	
1 st Molar	5 mo in utero	Cusps united	24-30 mo	11-18 mo	2.25 yr
2 nd Molar	6 mo in utero	Cusps tips still isolated	36 mo	20-30 mo	3 yr

Permanent Teeth

Tooth	Calcification Begins	Enamel Completed	Roots Completed	Eruption	Root Completed
MAXILLARY					
Central	3-4 mo	4-5 yr	9-10 y	7-8 y (3)	9-10 y
Lateral	10-12 mo	4-5 yr	11 y	8-9 y (5)	11 y
Canines	4-5 mo	6-7 yr	12-15 y	11-12 y (11)	12-15 y
1 st Premolar	18-24 mo	5-6 yr	12-13 y	10-11 y (7)	12-13 y
2 nd Premolar	24-30 mo	6-7 yr	12-14 y	10-12 y (9)	12-14 y
1 st Molar	Birth	30-36 mo	9-10 y	5.5-7 y (1)	9-10 y
2 nd Molar	30-36 mo	7-8 yr	14-16 y	12-14 y (12)	14-16 y
3 rd Molar	7-9 years			17-30 y (13)	
MANDIBULAR					
Central	4.5 mo in utero	4-5 yr	9-10 y	6-7 y (2)	9-10 y
Lateral	3-4 mo	4-5 yr	10 y	7-8 y (4)	10 y
Canines	4-5 mo	6-7 yr	12-15 y	9-11 y (6)	12-15 y
1 st Premolar	18-24 mo	5-6 yr	12-13 y	10-12 y (8)	12-13 y
2 nd Premolar	24-30 mo	6-7 yr	12-14 y	11-13 y (10)	12-14 y
1 st Molar	5 mo	30-36 mo	9-10 y	5.5-7 y (1a)	9-10 y
2 nd Molar	30-36 mo	7-8 yr	14-16 y	12-13 y (12a)	14-16 y
3 rd Molar	8-10 years			17-30 y (13a)	

* Figures in parentheses indicate order of eruption.

- Logan WHG and Kronfeld R. *Development of the human jaws and surrounding structures from birth to the age of 15 years.* JADA 1933; 20(3): 379-427.

- McDonald, Avery and Dean. *Dentistry for the Child and Adolescent 8th ed 2004: 177-179.*

A nine-year-old child presents with all permanent incisors erupted except the maxillary right central incisor. Based on clinical examination, the dentist should have a differential diagnosis to include:

- 1). Palatal impaction of the tooth
- 2). Congenital absence of the tooth
- 3). Insufficient root formation for eruption
- 4). Nasopalatine cyst inhibiting eruption
- 5). Supernumerary tooth inhibiting eruption

- A. 1, 2, and 3
- B. 1, 2, and 4
- C. 1, 2, and 5
- D. 1, 4, and 5
- E. 2, 3, and 5

Answer: D. 1, 4, and 5

Answer 2 is incorrect because congenitally missing maxillary central is extremely rare (<0.01%). Answer 3 is incorrect because if root formation is satisfactory of all the other incisors, then it is highly unlikely that one tooth will present with insufficient root formation.

Proffit 3rd ed. 470-471

Which methods are involved in a Cvek pulpotomy on a primary molar?

1. composite resin restoration
2. rubber dam isolation is optional
3. mechanically prepare the canal 1 mm short of the radiographic apex
4. gently rinse away any clots from the pulp with saline
5. removal of caries with a broach

- A. all of the above are acceptable methods for Cvek pulpotomy
- B. 1, 2, 3, 5
- C. 1, 3, 4, 5
- D. 1 and 4 only
- E. 2, 3, and 5

Answer: D

The Cvek pulpotomy procedure involves the removal of contaminated pulp tissue with a clean, round, high speed diamond burr, in an IMMATURE tooth. The aim of this procedure is to preserve vital, non-inflamed pulp tissue and biologically wall it off with a hard tissue barrier. In most situations, if the vital pulp tissue can be covered with a calcium hydroxide dressing, it is possible to form a dentin bridge over

the defect. It is preferable to preserve tooth vitality rather than start root-canal therapy. The usual method for a Cvek pulpotomy is:

- Check for tooth restorability, pathosis (otherwise, the pulpotomy is contraindicated)
- Place rubber dam (not an option)
- Pulp is washed with saline until hemorrhage stops. Any clot should then be gently rinsed away.
- Remove approximately 2mm coronal pulp tissue with sterile handpiece (high speed diamond), until vital non-inflamed tissue is present. (not a broach)
- Place non-setting calcium hydroxide over VITAL pulp tissue, not a blood clot
- Glass ionomer cement base is placed over the dressings and the tooth is restored with interim long term restoration.

The success of the Cvek pulpotomy is if after one year, there is the presence of a normal periodontal ligament and lamina dura, radiographic evidence of a calcified bridge and no radiographic evidence of internal or pathologic resorption.

McDonald & Avery 8th ed. Dentistry for the child adolescent. Mosby 2004: 464-466
Cameron and Widmer 2nd ed. Handbook of Pediatric Dentistry. Mosby 2003: 109-111

The Formocresol Pulpotomy technique involves placing cotton pellets moistened with 2% formocresol directly over the pulp horns, then temporizing with a composite resin. Three weeks later, the restoration is removed and the cotton pellet is replaced with glass ionomer.

- a) First statement is true, second is false
- b) First statement is false, second statement is true
- c) Both are true
- d) Both are false

Answer: d

The formocresol pulpotomy technique is recommended in the treatment of primary teeth with carious exposures and incomplete apices. It is completed during a SINGLE OFFICE VISIT. The procedure is as follows:

- Preoperative radiographs
- Local anesthesia/rubber dam placement
- Remove caries prior to entering pulp chamber, prepare for SSC
- Un-roof pulp chamber with slow speed round bur, remove coronal pulp tissue
- Moist cotton pellet on pulp stumps to control hemorrhage for 1-2 minutes
- Formocresol vapored cotton pellet against pulp stumps for 5 minutes
- Remove cotton pellet and place thick paste of ZOE into chamber and condense
- Restore with stainless steel crown.

Although the success rate of formocresol ranges from 70% to 97%, there is much controversy over its usage mainly due to its potentially immunogenic/mutagenic effects.

Therefore care must be taken to avoid contact with the gingival tissues and use for shorter periods of time with a 1:5 dilution of Buckley's solution. Originally, the aim of using formocresol was to completely mummify any remaining pulpal tissue. Alternative substitutes for formocresol: 2% Glutaraldehyde, Calcium Hydroxide, 20% Ferric sulfate, Iodoform, Ledermix (paste containing corticosteroid and an antibiotic), Electrosurgery and laser, MTA or allogenic bone morphogenic protein.

Cameron and Widmer 2nd ed. *Handbook of Pediatric Dentistry*. Mosby 2003: 76-79
McDonald and Avery. *Dentistry for the Child and Adolescent*. Mosby 6th ed. 1994: 440-441

Casas et al. *Do we still need formocresol in Pediatric Dentistry?* J Can Dent Assoc 2005 71(10): 749-751.

Serial extraction is directed toward mild dental crowding. Treatment should begin in the early mixed dentition stage.

- A. First is true, second statement is false
- B. First is false, second statement is true
- C. Both are false
- D. Both are true

Answer: B

Serial extraction is a procedure that should take place in children with SEVERE crowding, during the early mixed dentition. By having a planned sequence of tooth removal, crowding and irregularities in the transition from primary to permanent dentition can be reduced. Typically, baby teeth are removed with the expectation that certain permanent teeth will erupt early; and their removal will allow most - if not all space - to close naturally. This can significantly shorten the duration of treatment, as well as its complexity, and greatly reduce its cost.

The sequence of treatment is as follows: removal of the primary canine teeth once the two front secondary incisors on top and bottom have erupted. Then after 2 years, when the first premolars and permanent canines are ready to erupt, re-evaluate the crowding and remove the first premolars.

It is best to use this method when no skeletal problem exists and the space discrepancy is large – greater than 10mm per arch. The goal is to influence certain permanent teeth to erupt without becoming impacted, so foresight is necessary.

Proffit WR. *Contemporary Orthodontics* 4th ed. Mosby Publishing 2007:490-92

In the first stage of orthodontic treatment, steel wires offer a better combination of strength and springiness than do NiTi. Initial archwires should provide a heavy, intermittent force between 80 and 100 grams.

- A. both statements are true and related
- B. both statements are true and not related

- C. first statement is true
- D. second statement is true
- E. neither statement are true or related.

Answer E

There are three main stages of comprehensive orthodontic treatment: 1) alignment and leveling, 2) correction of molar relationship and space closure and 3) finishing. The initial archwires for alignment should provide light, continuous force of approximately 50 grams to produce the most efficient tipping tooth movement. Heavy force is to be avoided. NiTi alloys have two remarkable properties that are unique in dentistry – **shape memory** and **superelasticity**. Shape memory is the ability of the material to “remember” its original shape after being plastically deformed. Stainless steel wires are best used in the final stage after the teeth have been aligned and torqued to their desired position.

Proffit WR. *Contemporary Orthodontics* 4th ed. Mosby Publishing 2007:370-375, 552-555

The rationale for retaining teeth in their post orthodontic treatment position includes all of the following, except:

- a. **Allows for reorganization of the gingival and periodontal tissues.**
- b. **To minimize changes due to growth.**
- c. **To permit neuromuscular adaptation to the corrected tooth position.**
- d. **To maintain teeth in unstable positions which is sometimes necessary due to compromise or esthetics.**
- e. **None of the above.**

Answer: e

Retention following orthodontic treatment has been defined by Moyers as, “The holding of teeth following orthodontic treatment in the treated position for the period of time necessary for the maintenance of the result.”¹ The retention phase is considered by some to be one of the most difficult aspects of the entire orthodontic treatment process. Oppenheim’s statement in 1934 that, “Retention is the most difficult problem in orthodontia; in fact it is the problem,”² still holds true in many cases today.

The rationale for holding the teeth in their treated position is to:

- allow for reorganization of the gingival and periodontal tissues;
- minimize changes due to growth;
- permit neuromuscular adaptation to the corrected tooth position; and
- maintain teeth in unstable positions (sometimes necessary due to compromise or esthetics).

Following orthodontic treatment, a reduction in arch length and intercanine width is evident. Intermolar width, if expanded during treatment, tends to return toward the pre-treatment value. The reported changes in intercanine and intermolar width are greater in the mandibular arch than the maxillary arch. Although most of the arch changes are seen before age 30, mandibular anterior crowding continues into the fifth decade. As summarized by Little,¹² "Treated cases should be viewed as dynamic and constantly changing, at least through the third and fourth decade and perhaps throughout life."

Retainers should be placed as soon as possible following bracket removal. Retainer wires should not be placed across the occlusion through extraction sites, as spaces may reopen. In the presence of periodontal problems, fixed retention rather than removable is preferred, as removable appliances may lead to pathologic pocket formation in the absence of adequate home care.

References: Blake M, Garvey MT. Rationale for retention following orthodontic treatment. J Can Dent Assoc 1998; 64:640-3.

Textbook: Contemporary Orthodontics, Fourth Edition. Proffit. 2007. Pgs. 617-23.

What is the maximum length of time elastomeric orthodontic separators should be kept in place?

- 3 days**
- 7 days**
- 14 days**
- 21 days**

Answer: c

When tight interproximal contacts make it impossible to seat an orthodontic band some device needs to be used to separate the teeth before banding. There are a variety of types of separators that can be used, but they all work on the same principle which is, to force or wedge the teeth apart long enough for initial tooth movement to occur so that the teeth will be slightly separated and a band can be placed. The two main methods used for separation of posterior teeth are: (1) separating springs, which exert a scissors action

above and below the contact, typically opening the space for banding in approximately one week; and (2) elastomeric separators, which surround the contact point and squeeze the teeth apart over a period of several days. Patients generally tolerate steel spring separators better, but these separators tend to come loose and may fall out as they accomplish their purpose. Elastomeric separators are more difficult to place, but are retained well and may be kept in place longer periods of time. Elastomeric separators are radiolucent and can present a problem if one is lost in the interproximal space. It is recommended to use brightly colored separators so that they are more visible. These separators should not be kept in place for longer than two weeks.

Reference: Textbook: Contemporary Orthodontics, Fourth Edition. Proffit. 2007. Pg. 412.

Which of the following statements is/are false concerning non-nutritive sucking habits?

- a. Girls are more likely than boys to continue sucking habits after beginning school.**
- b. As long as the habit stops before the eruption of the permanent incisor, most of the changes resolve spontaneously.**
- c. The effects on the soft and hard tissues associated with a non-nutritive sucking habit depend on the frequency and the duration of the habit.**
- d. Pacifiers that are designed to produce a more physiologic sucking pattern have been shown to be more beneficial when compared to other pacifiers or finger sucking.**

Answer: d

During the primary dentition and early mixed dentition years, many children engage in digit and pacifier sucking. It is possible to deform the alveolus and dentition during the primary dentition years with a prolonged, intense habit, but most of the effect occurs on the eruption of the permanent anterior teeth. Girls are more likely than boys to continue sucking habits after school begins. The effect of these habits on the hard and soft tissues depends on the duration and frequency of the habit. With frequent and prolonged sucking, maxillary incisors are tipped facially, mandibular incisors are tipped lingually and eruption of some incisors is impeded. Overjet increases and overbite decreases. Sometimes posterior crossbites result. There is some evidence that use of pacifiers increases the incidence of posterior crossbites more often than digit sucking. Pacifier shapes that are designed to produce a more physiologic sucking pattern have not been proven to be beneficial when compared with other pacifiers or to finger sucking. Most children discontinue pacifier use by age 4 or 5, but digit sucking may continue. The social pressures of school are usually a strong deterrent. As long as the habit stops before the eruption of the permanent incisor, most of the changes resolve spontaneously.

Reference: Textbook: Contemporary Orthodontics, Fourth Edition. Proffit. 2007. Pgs. 443-5.

Which one of the following statements is TRUE concerning treatment for non-nutritive sucking habits?

- a. If a child does not want to quit sucking, habit therapy or appliance therapy is indicated.**
- b. A straightforward discussion between the child and the dentist that expresses concern and includes an explanation by the dentist is often ineffective.**
- c. The promise of a large reward if the child quits the sucking habit can be an effective method to get the child to quit the habit.**
- d. When a sucking habit has ceased , an appliance should be retained in place for approximately 3 months to ensure that the habit has truly stopped.**

Answer: c

If a child does not want to quit the sucking, habit therapy, especially appliance therapy, is not indicated. If the child is still sucking as the permanent incisors begin erupting it is important to try to prevent the habit. The simplest approach to habit therapy is a straightforward discussion between the child and the dentist that expresses concern and includes an explanation by the dentist. This "adult" approach (and restraint from intervention by the parents) is often enough to terminate the habit, but is most effective with older children.

Another level of intervention is reminder therapy. This is useful for the child who wants to quit but needs help. One of the simplest approaches is to secure an adhesive bandage with waterproof tape on the finger that is sucked.

If reminder therapy fails, a reward system can be implemented that provides a small tangible reward daily for not engaging in the habit. In some cases, a large reward may be negotiated for complete cessation of the habit.

If all else fails and the child really wants to quit the habit a loose fitting elastic bandage wrapped around the elbow which prevents the arm from flexing and the fingers from being sucked can be employed. This should only be used at night and 6 to 8 weeks of intervention should be sufficient. This should not be viewed as a punishment by the child.

If the previous methods have not succeeded in eliminating the habit, a removable appliance is contraindicated because lack of compliance is part of the problem. The child

who wants to stop can be fitted with a cemented reminder appliance that also actively impedes sucking. These appliances can be deformed and removed by children who are not compliant and who do not truly wish to stop the habit. This should not be viewed by the child as a punishment but rather a "helping hand". When sucking ceases, the appliance should be retained in place for approximately 6 months to ensure the habit has truly stopped. These appliances can trap food and lead to mouth odor, so excellent oral hygiene is beneficial.

Open bites associated with sucking in children with normal jaw relationships often resolve after sucking stops and the remaining permanent teeth erupt. An appliance to laterally expand a constricted maxillary arch or retract flared and spaced incisors may be needed, but the open bite should require no further treatment in children with good skeletal proportions.

Reference: Textbook: Contemporary Orthodontics, Fourth Edition. Proffit. 2007. Pgs. 445-8.

Match the following dental film processing errors with their effect on the radiograph:

- | | |
|------------------------------|--|
| a. Lighter radiograph | ___ Temperature too high |
| b. Darker radiograph | ___ Time too short |
| | ___ Developer concentration is too high |
| | ___ Diluted or contaminated developer |
| | ___ Inadequate fixation |
| | ___ Accidental exposure to light |

Answer:

- | | |
|------------------------------|--|
| a. Lighter radiograph | <u> b </u> Temperature too high |
| b. Darker radiograph | <u> a </u> Time too short |
| | <u> b </u> Developer concentration is too high |

a **Diluted or contaminated developer**

 b **Inadequate fixation**

 b **Accidental exposure to light**

Inattention to detail with film processing can lead to many problems that result in poor radiographs. This in turn leads to loss of diagnostic information and loss of professional and patient time. The following is a listing of common causes of faulty radiographs:

I. *Light radiographs*

A. Processing errors

1. Underdevelopment
 - a. Temperature too low
 - b. Time too short
 - c. Inaccurate thermometer
2. Depleted developer solution
3. Diluted or contaminated developer
4. Excessive fixation

B. Underexposure

1. Insufficient mA
2. Insufficient kVp
3. Insufficient time
4. Excessive film-source distance
5. Film packet reversed in mouth

II. *Dark radiographs*

A. Processing errors

1. Overdevelopment
 - a. Temperature too high
 - b. Time too long
2. Developer concentration too high
3. Inadequate fixation
4. Accidental exposure to light
5. Improper safelighting

B. Overexposure

1. Excessive mA
2. Excessive kVp
3. Excessive time
4. Insufficient film-source distance

III. *Insufficient contrast*

- A. Underdevelopment
- B. Underexposure
- C. Excessive kVp
- D. Excessive film fog

IV. *Film fog*

- A. Improper safelighting conditions
 - 1. Improper filter
 - 2. Excessive bulb wattage
 - 3. Inadequate distance between safe light and working surface
 - 4. Prolonged exposure of films to safelight
- B. Light leaks
 - 1. Cracked safelight filter
 - 2. Lights from doors, vents, etc.
- C. Overdevelopment
- D. Contaminated solutions
- E. Deteriorated film
 - 1. Stored at high temperature
 - 2. Stored at high humidity
 - 3. Exposed to irradiation
 - 4. Outdated

V. *Dark spots or lines on radiographs*

- A. Fingerprint contamination
- B. Black wrapping paper sticking to film surface
- C. Film in contact with tank or another film during fixation
- D. Film contaminated with developer before processing
- E. Excessive bending of film

VI. *Light spots on radiographs*

- A. Film contaminated with fixer before processing
- B. Film in contact with tank or another film during development

VII. *Yellow or brown stains on radiograph*

- A. Depleted developer
- B. Depleted fixer
- C. Insufficient washing
- D. Contaminated solutions

VIII. *Blurred radiographs*

- A. Movement of patient
- B. Movement of x-ray tube head
- C. Double exposure

IX. *Radiographs with partial images*

- A. Top of film not immersed in developing solutions

B. Misalignment of x-ray tube head (i.e. cone cut)

Reference: Textbook: Oral Radiology Principles and Interpretation. Goaz and White. 2nd Edition. 1987. Pgs 136-8.

In the maxillary arch, the primate space is located between the lateral incisors and the canines, whereas in the mandibular arch, the space is between the canines and first molars. The measurement of Leeway space in the mandibular arch is greater than that in the maxillary arch.

- a. Both statements are true.
- b. The first statement is true, the second statement is false.
- c. The first statement is false, the second statement is true.
- d. Both statements are false.

Answer: a

Spacing is normal throughout the anterior part of the primary dentition but is most noticeable in two locations called the primate spaces. In the maxillary arch, the primate space is located between the lateral incisors and canines, whereas in the mandibular arch, the space is between the canines and first molars. The primate spaces are normally present from the time the teeth erupt. Developmental spaces between the incisors are often present from the beginning, but become somewhat larger as the child grows and the alveolar processes expand. Generalized spacing of the primary teeth is a requirement for proper alignment of the permanent incisors.

Leeway space is the difference between the sum of the M-D width of C, D, E and permanent teeth 3, 4 and 5. The mandibular primary second molar is on average 2mm larger than the second premolar, while in the maxillary arch, the primary second molar is 1.5mm larger. The primary first molar is only slightly larger than the first premolar, but does contribute an extra 0.5mm in the mandible. The result is that each side in the mandibular arch contains about 2.5mm of Leeway space, while the maxillary arch has about 1.5mm on each side. These numbers do show some variability in different studies. When the second primary molars are lost, the first permanent molars move forward relatively rapidly into this Leeway space. This space can be useful to relieve crowding if orthodontic treatment is needed.

Reference: Textbook: Contemporary Orthodontics, Fourth Edition. Proffit. 2007. Pgs. 86, 101.

Mesial movement and migration of the first permanent molar often occurs before eruption in instances of premature loss of the first primary molar. A distal shoe appliance may be used to maintain space or, in some instances, to influence the active eruption of the first permanent molar in a distal direction.

- A. Both statements are true
- B. First statement is true, second statement is false
- C. First statement is false, second statement is true
- D. Both statements are false

Answer is **C**

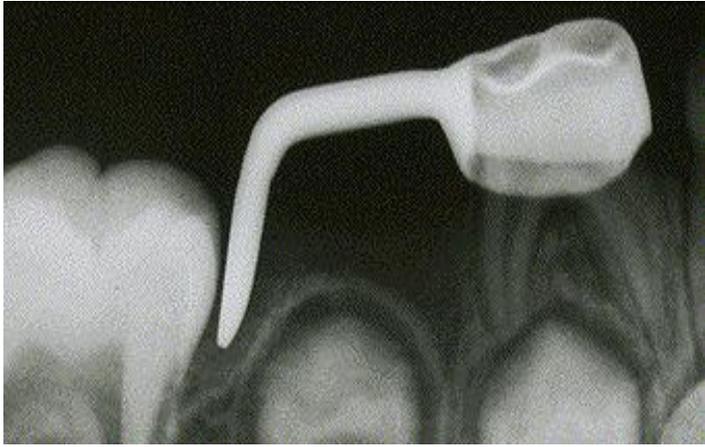
Loss of the second primary molar before eruption of the first permanent molar

Mesial movement and migration of the first permanent molar often occurs before eruption in instances of premature loss of the **second** primary molar. This is one of the most difficult problems of the developing dentition to confront the pediatric dentist. Use of a space maintainer that will guide the first permanent molar into its normal position is indicated.

The Distal Shoe Appliance

Roche has advocated a crown and band appliance with a distal intralingival extension. This appliance or modifications of it may be used to maintain space or, in some instances, to influence the active eruption of the first permanent molar in a distal direction.







References:

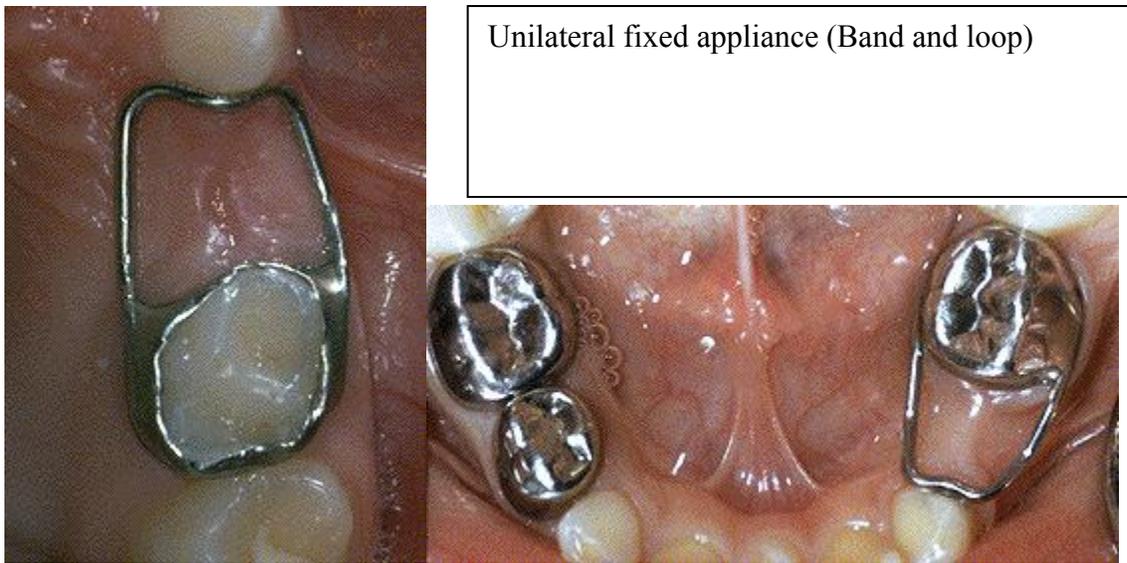
McDonald RE, et al. Dentistry for the Child and Adolescent. 8th edition, Mosby 2004, pp 636.

In a 4 year old patient missing teeth # L and S which of the following would NOT be indicated for space maintenance?

- A. Mandibular fixed bilateral space maintainer
- B. Band and loop space maintainer
- C. Mandibular removable bilateral space maintainer
- D. Distal shoe space maintainer

Answer is **D**

A distal shoe is used when a primary second molar is prematurely lost



Removable bilateral appliance

Fixed Bilateral appliance

References:

McDonald RE, et al. Dentistry for the Child and Adolescent. 8th edition, Mosby 2004, pp 634-46

Match the following asthma medications with their mode of action. Answers may be used more than once.

- | | |
|--------------------------------------|--------------------------------|
| A. Azmacort _____
bronchodilators | a. short-acting |
| B. Singulair _____ | b. long-acting bronchodilators |
| C. Serevent _____ | c. leukotriene inhibitors |
| D. Intal _____ | d. inhaled steroids |
| E. Proventil _____ | e. cromolyn sodium |
| F. Aerobid _____ | |
| G. Flovent _____ | |
| H. Ventolin _____ | |

The answer is:

- A. Azmacort** d _____
B. Singulair c _____
C. Serevent b _____
D. Intal e _____
E. Proventil a _____
F. Aerobid d _____
G. Flovent d _____
H. Ventolin a _____

References:

Agertoft L, et al. Physician Toolkit To Support Effective Use of Pediatric Asthma Medications. New England Public Health And Managed Care Collaborative, May 2003.

All of the following would be considered as **Very High Risk Cases** in pediatric sedation **EXCEPT:**

- A. The child has had previous adverse experience with sedation.
- B. The child is allergic to products that may be used during the procedure (eg. latex products or iodine).
- C. The child is less than 2 months old.
- D. The child is unable to handle secretions without aspiration at baseline.

E. The child has significant systemic disturbance or disease (ASA3 or greater).

The answer is: **B**

1. **EVERY PEDIATRIC PATIENT IS CONSIDERED AT RISK** for losing their protective reflexes whenever sedation is given. An otherwise previously healthy pediatric patient undergoing mild to moderate sedation is at **lower risk** for losing protective reflexes than a child with comorbid conditions or other underlying health conditions that could compromise cardiorespiratory status or interfere with the metabolism of sedative agents.

2. **HIGH RISK CASES** require advanced training and expertise for delivery and management of sedation.

These cases should be managed by a pediatric intensivist or other pediatric specialist specifically credentialed for moderate sedation within their area of expertise. Characteristics that may indicate a

child is a **high risk** candidate for sedation include:

- The child has:
 - ⇒ received opioids, benzodiazepines, or initiated therapy with any CNS depressant within the past 6 hours; or
 - ⇒ started extended release opioids or received methadone or intraspinal/epidural narcotics within the past 24 hours; or
 - ⇒ started opioids via an implantable pump within the past 72 hours.
- The child will receive two or more sedative drugs concomitantly or sequentially such that there is an overlap in the duration of action and/or results in moderate to deep sedation (see Appendix B).
- The child will receive single agent drugs that are associated with a high likelihood of deep sedation.

This includes pentobarbital, and ketamine by any route.

- The child is allergic to products that may be used during the procedure (eg. latex products or iodine).

3. **VERY HIGH RISK CASES** require advanced training and expertise for delivery and management of sedation. These cases should be managed by a credentialed pediatric intensivist and may require consultation with or support from the Anesthesiology Department. Characteristics that may indicate a

child is at **very high risk** with sedation include:

- The child is less than 2 months old.
- The child is unable to handle secretions without aspiration at baseline.
- The child is unable to maintain a patent airway independently at baseline (excludes mechanically ventilated children).
- The child has significant systemic disturbance or disease (ASA3 or greater).
- The child has cardiac and/or respiratory status that makes risk of cardiac or pulmonary compromise

likely.

- The child has altered mental status making assessment of level of awareness, pain, and response to administered medications difficult.
- The child has had previous adverse experience with sedation.
- The child will receive intravenous anesthetic agents such as propofol, etomidate, methohexital or thiopental. These agents easily and commonly produce general anesthesia.
- The child is allergic or sensitive to sedative or analgesic drugs.

References:

McDonald RE, et al. Dentistry for the Child and Adolescent. 8th edition, Mosby 2004, pp 285-311

The helical uprighting spring is probably the most popular appliance used for molar uprighting. It exerts an extrusive force on the molar during uprighting.

- A. Both statements are true
- B. First statement is true, second statement is false
- C. First statement is false, second statement is true
- D. Both statements are false

The answer is: **A**

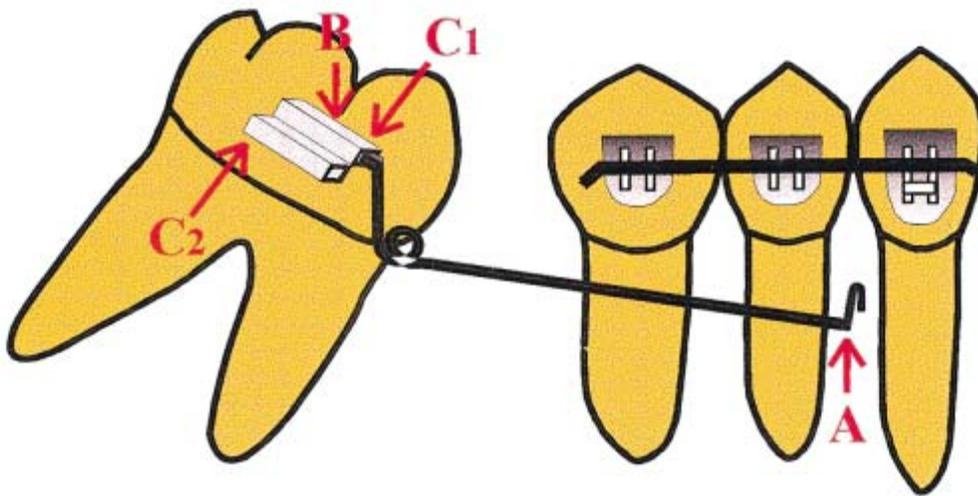


Figure 1. Forces on the wire resulting in elastic deformation of the wire are shown. An occlusally directed force acting on the mesial aspect of

the wire is the most obvious force (A). A gingivally directed force is exerted on the wire by the molar bracket (B, C1 and C2). The molar bracket also exerts two forces that keep the wire from spinning in a counterclockwise direction.

Figure 2. Forces on the teeth from the elastically deformed wire are shown.

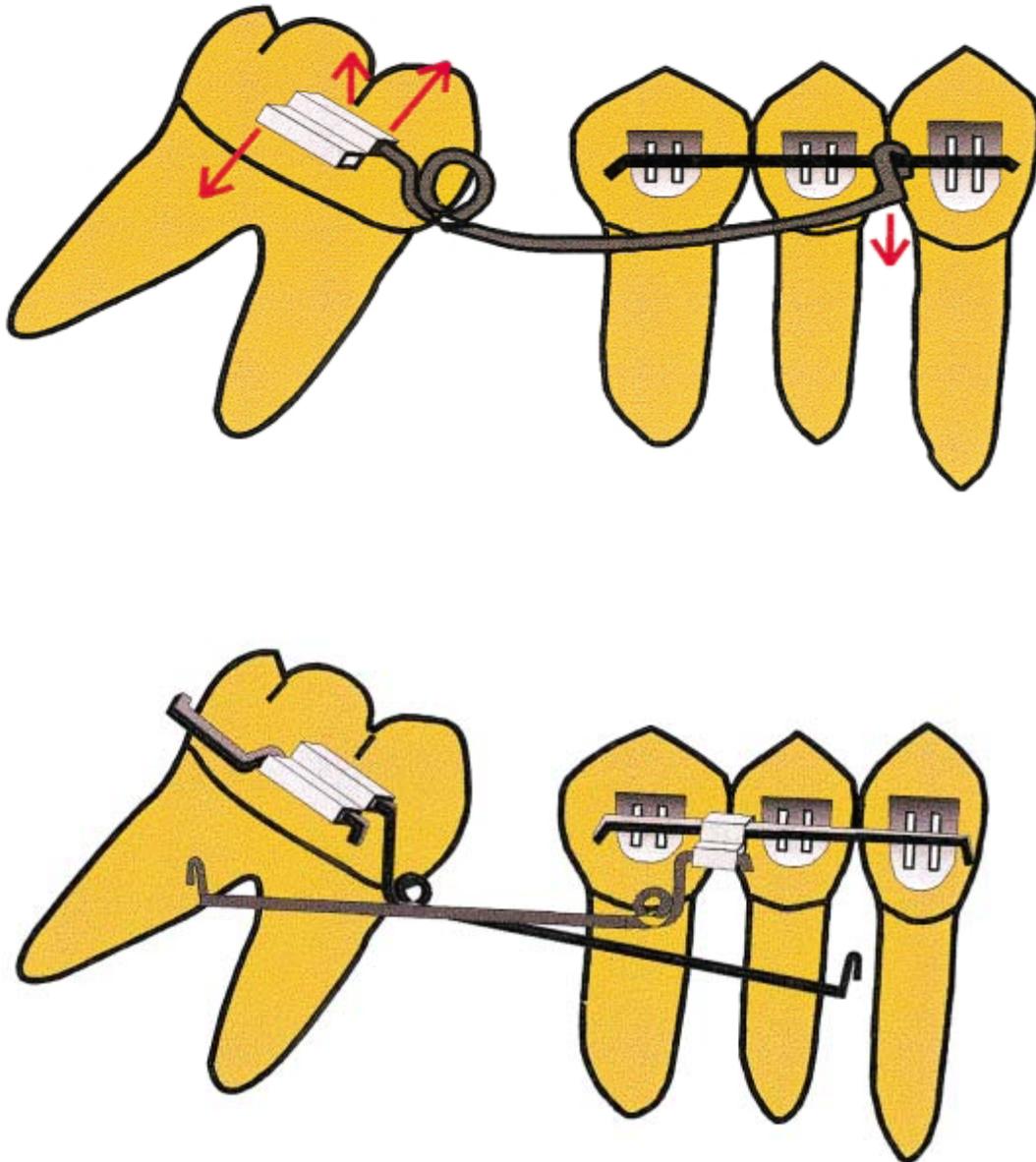


Figure 3. Two helical uprighting springs oriented to produce molar uprighting without extrusion.

References:

Shellheart WG, et al. Uprighting molars without extrusion. JADA, Vol. 130, March 2001. pp 381-85.

Which of the following regarding fiberotomy surgery to help orthodontic retention is/are true?

1. The method is particularly effective in preventing rotational relapse.
 2. Clinical healing is normally complete in 4-6 weeks
 3. The fiberotomy procedure is recommended during the last 4-6 months of active orthodontic movement
 4. A common finding is an increase in sulcus depth and/or gingival labial recession
-
- a. 1 and 3
 - b. 1,2 and 3
 - c. 2 and 4
 - d. 4 only
 - e. 1 only
 - f. All are correct
 - g. None are correct

Answer: e. 1 only.

The fiberotomy procedure is useful in preventing relapse of rotational correction in orthodontics. According to Lindhe et al, two soft tissue periodontal components may influence stability: the principle fibers of the pdl and the supra-alveolar fibers. The fibers of the periodontal ligament and transeptal groups seem to remodel quickly, with complete histological remodeling in 2-3 months. However, the supra-alveolar fibers have a slow turnover. From a clinical point of view, the supracrestal gingival tissues seemingly contribute to rotational relapse as evidenced by the effect of the circumferential supracrestal fiberotome (CSF) technique, which consists of inserting a scalpel into the gingival sulcus and severing the epithelial attachment surrounding the involved teeth and the transeptal fibers in the periodontal ligament space. This technique is NOT recommended during active tooth movement or in the presence of gingival inflammation. When performed in HEALTHY tissues AFTER orthodontic therapy, negligible loss of attachment occurs. Long term studies show that the procedure is more effective in preventing maxillary relapse than mandibular relapse, and no clinically significant increases in sulcus depth or signs of gingival labial recession were found.

Lindhe, et al, Clinical periodontology and implant dentistry, 3rd ed., Copyright 1997 by Munksgaard, Copenhagen, ISBN 87-16-12060-4, p. 783-785.

Which of the following concerning forces in orthodontic movement are true?

1. By convention, forces and movements that act in a mesial direction are positive (+), that act in a distal direction are negative (-), that act in a buccal direction are positive (+) and that act in a lingual direction are negative (-).
 2. Translation movements (bodily movement) produce a relatively uniform stress distribution along the root while rotation creates a varying distribution with the highest stress at the apex, the next highest at the alveolar crest and the least at the center of resistance.
 3. Pure translation and pure rotation are considered the two basic types of tooth displacement with other types being a combination of these.
 4. When force is applied to a tooth, it moves the most during the first 7 days, then slows to about a third of the initial rate for 7 days and finally does not move or shows a relatively low rate of displacement after the first 14 days.
- a. 1 and 3
 - b. 1,2 and 3
 - c. 2 and 4
 - d. 4 only
 - e. All are correct

Answer: b. 1,2 and 3.

By convention, forces that move teeth in extrusive, mesial or buccal directions are positive while the opposite directions are negative. Three mutually perpendicular planes are looked at regarding movement: buccolingual or labiolingual oriented through the long axis of the tooth, mesiodistal also oriented through the long axis of the tooth and a transverse plane intersecting the first two at right angles. Forces are described as creating either bodily movement of the tooth or rotation of the tooth, or a combination of the above. As a tooth bodily moves (translation), a uniform stress distribution along the root occurs. A single force near the center of the root would theoretically create pure translation. In most instances, however, placing a force through the center of resistance is not practical, so a force system must be placed on the crown of the tooth that acts through a center of resistance. A lingually directed single force placed on the crown of a tooth produces a center of rotation between the center of resistance and the apex, while if a counterclockwise moment (lingual root torque) is applied, the center of rotation moves to the apex. If an additional moment in the same direction is placed on the tooth, the center of rotation moves to infinity, and the tooth translates. If a relatively constant force is applied on a tooth, the resulting movement can be differentiated into three phases. The initial phase is characterized by a period of rapid tooth movement that usually lasts a few days. The onset occurs immediately after application of a force and seems to represent

displacement of the tooth in the periodontal space. Next is a lag phase with little or no movement, followed by a post lag phase during which the movement increases again. Various theories have been developed to explain the lag phase, with the two most common being that the lag is caused by nonvitalization of the PDL in areas of maximal stress that halts movement until cellular process revitalize the areas and that the lag period represents the interval required for absorption of compact bone of the lamina dura. The lag phase typically lasts during the second week and is followed by an increase in movement that lasts for about an additional 2 weeks...

Graber et al, Orthodontics Current Principles and techniques, 4th ed., p. 293-301
Copyright 2005 by Elsevier Inc., ISBN -13: 978-0-323-02621-5

Match Angle's three classes of malocclusion with their correct first molar occlusal relationship:

- | | |
|--------------|--|
| a. Class I | 1. Lower molar DISTALLY positioned relative to upper molar |
| b. Class II | 2. Lower molar MESIALLY positioned relative to upper molar |
| c. Class III | 3. Normal relationship of the molars, but line of occlusion incorrect due to malposed teeth, rotations or other causes |

Answer: a. 3
b. 1
c. 2

Edward Angle in the 1890's developed three classes of malocclusion based on the occlusal relationships of the first molars. His classification also included Class I normal for a total of 4 occlusal relationships. He also included a line of occlusion, which should be a smooth curve passing through the central fossa of each upper molar and across the cingulum of the upper canine and incisor teeth. The line runs along the buccal cusps and incisal edges of the lower teeth as well. A class I occlusion would have a correct line of occlusion. A class I malocclusion would have the same molar relationship as a class I occlusion, but the line of occlusion would be altered. A class II malocclusion would have the lower molar mesially positioned relative to the upper molar while the line of occlusion could be either correct or incorrect. A class III malocclusion would have the lower molar distally positioned in relation to the upper molar, and like the class II malocclusion, the line of occlusion could be either correct or incorrect.

Proffit et al, Contemporary Orthodontics, 4th ed.,p. 4-5 Copyright 2007 by Mosby, Inc., ISBN -10: 0_323-04046-2

All of the following apply to radiographic infection Control EXCEPT :

- a. Apply universal precautions
- b. Disinfect and cover x-ray unit, working surfaces, chair and apron
- c. Sterilize non-disposable instruments
- d. Use barrier-protected film (sensor) or disposable container
- e. Spray processing equipment down with bleach after each use

Answer: e.

The potential for cross-contamination increases dramatically when radiography is used. An operator's hands may become contacted by contact with a patient's mouth, saliva-contaminated films and film holders. The operator must adjust the x-ray tube head as well as the x-ray machine control panel, open film packets and process films in a darkroom for film radiography or manipulate computer controls in digital radiography. For this reason, universal precautions should be followed with all patients. Under these precautions, all human blood and saliva are treated as if known to be infectious with HIV and hepatitis B virus. Always wear gloves when handling contaminated materials. Keep charts away from sources of contamination. Cover control surfaces that must be touched while wearing contaminated gloves. Disinfect surfaces between patients even if they were covered. Operators should avoid touching walls and other surfaces with contaminated gloves. Instruments should be disposable or sterilized after use. Barrier-protected film (sensor) or disposable containers should be used, the packet containing the film disinfected by immersion in a disinfectant or, in the darkroom, the packet opened and the film dropped into a clean cup with-out touching, the gloves removed and then the film placed into the processor.

White and Pharoah, Oral Radiology, principles and interpretation, 5th ed., p. 115-120
Copyright 2004 by Mosby inc, ISBN-10: 0-323-02001-1

Your patient is being evaluated for mandibular surgery to help correct a Class 2 malocclusion. What films may help see the condylar neck area?

- a. PA Ceph
- b. Reverse Towne
- c. Lateral Ramus
- d. Panoramic
- e. Waters

1. a and b
2. a and c
3. a,b,c and d
4. c and d
5. d only
6. all

Answer: 3. a,b,c and d

Scan p. 212, Table 11-1!!

The following extraoral radiographic examinations help with diagnosis and treatment planning relative to specific areas:

Lateral Skull Projection:

The image receptor is parallel to the patient's midsagittal plane with the site of interest placed toward the receptor. The central beam is perpendicular to the midsagittal plane of the patient and the plane of the receptor, centered over the external auditory meatus.

Submentovertex projection:

The image receptor is parallel to the patient's transverse plane and perpendicular to the midsagittal and coronal planes. The patient's neck is extended as far backwards as possible, with the canthomeatal line forming a 10-degree angle with the image receptor. The x-ray beam is perpendicular to the image receptor, directed from below the mandible towards the vertex of the skull.

Waters projection:

The receptor is placed in front of the patient and perpendicular to the midsagittal plane. The patient's head is tilted up. If the patient's mouth is open, the sphenoid sinus will be superimposed over the palate. The x-ray beam is perpendicular to the image receptor, centered on the maxillary sinus area.

Posteroanterior Ceph projection:

The receptor is placed in front of the patient, perpendicular to the midsagittal plane and parallel to the coronal plane. The patient is placed with the Frankfurt plane perpendicular to the image receptor. The x-ray beam is perpendicular to the receptor, directed from the posterior to the anterior...

Reverse-Towne projection:

The receptor is in front of the patient perpendicular to the midsagittal and parallel to the coronal plane. The patient's head is tilted downward. If the patient opens his mouth, the visualization of the condyles will improve. The central beam is perpendicular to the receptor and parallel to the patient's midsagittal plane and centered at the condyles.

Mandibular Oblique Lateral projections:

The image receptor is placed against the patient's cheek on the side of interest and centered on the molar-premolar area. The head is tilted towards the side being examined, and the mandible protruded. The central beam is directed toward the molar-premolar region.

Mandibular ramus projection:

The image receptor is placed over the ramus and far enough posteriorly to include the condyle. The lower border of the cassette is parallel and at least 2cm below the inferior border of the mandible. The head is tilted towards the side being examined. The beam is directed towards the center of the imaged ramus.

Panorex projections:

The panoramic projection provides an overall view of the teeth and jaws, allowing for use as a screening projection. However, mild osseous changes may be obscured and superimposition of the skull base and zygomatic arches block much of the view as well...

[Add chart](#)

White and Pharoah, Oral Radiology, principles and interpretation, 5th ed., Copyright 2004 by Mosby inc, ISBN-10: 0-323-02001-1 p. 210-224,543-544

How the film speed can be increased?

True or False.

Film speed can be increased by processing the film at a lower temperature. Film speed group D is faster than group F.

- a) First is true, second is false.
- b) Both are true.
- c) Both are false.
- d) First one is false and the second one is true.

Answer: c

Radiographic speed refers to the amount of radiation required to produce an image of a standard density.

Film speed is expressed as the reciprocal of the exposure (roentgens) required to produce an optical density of 1 above gross fog. A fast film requires low exposure to produce a density of 1. Film speed is controlled by the size of the silver halide grains and their silver content.

Intraoral Film speed classification	
Film speed group	Speed Range (reciprocal roentgens)
C	6-12
D	12-24
E	24-48

D or faster are appropriate for dental radiography. Kodak Insight film (E or F) requires about half the exposure of Kodak Ultra-Speed (D).

Film speed can be increased by processing the film at a higher temperature at the expense of increased film fog and graininess. Processing in depleted solutions can lower the effective speed.

Reference: White, Pharoah. Oral Radiology principles and interpretation. Fifth edition. P 81-82

In a radiograph an object appears to be apical to the mandibular second premolar, when another radiograph angulated from the mesial is taken, the object appears to have moved mesially with respect to the second premolar.

Where is the object related to the second premolar?

- a) Lingual
- b) Mesial
- c) Buccal
- d) Distal

Answer: a) Lingual (SLOB: same lingual, opposite buccal)

SLOB or tube shift technique: Same lingual, Opposite buccal. If the object in question appears to move in the same direction with respect to the reference structures as does the x-ray tube, it is on the lingual aspect of the reference object; if it appears to move in the opposite direction of the x-ray tube, it is on the buccal aspect. If does not move with respect to the reference object, it lies at the same depth (same vertical plane) as the reference object.

Reference: White, Pharoah. Oral Radiology principles and interpretation. Fifth edition. P 91-92

Film processing errors

Match the problem with the cause.

- | | |
|---------------------------|--|
| a) Light radiographs | 1.Excessive time in wash water |
| b) Dark radiographs | 2. Top of film not immersed in developing solution |
| c) Insufficient Contrast | 3. Insufficient washing |
| d) Film Fog | 4. Deteriorated Film |
| e) Light spots | 5. Underexposure |
| f) Yellow or brown stains | 6. Double exposure |
| g) Blurring | 7. Excessive bending of film |
| h) Partial Images | 8. Developer concentration too high |

i) Emulsion Peel

9. Underdevelopment

Answer:

- a) 5
- b) 8
- c) 9
- d) 4
- e) 7
- f) 3
- g) 6
- h) 2
- i) 1

Light radiographs:

Processing errors

Underdevelopment (temperature too low; time too short; thermometer inaccurate)***

Depleted developing solution+

Diluted or contaminated developer

Excessive fixation

Underexposure

Insufficient milliamperage

Insufficient peak kilovoltages

Insufficient time

Film-source distance too great

Film packet reverse in mouth (marks due to lead foil)

Dark radiographs:

Processing errors

Overdevelopment (temperature too high; time too long)

Developer concentration too high

Accidental exposure to light

Inadequate fixation

Improper safelighting

Overexposure

Excessive milliamperage

Excessive peak voltage

Excessive time

Film-source distance too short

Insufficient contrast:

Underdevelopment***

Underexposure

Excessive peak voltage

Excessive film fog

Film Fog

Improper safelighting
Light leaks
Overdevelopment
Contaminated Solution++

Deteriorated Film**Dark spots or lines**

Fingerprint contamination
Black wrapping paper sticking to film surface
Film in contact with tank or another film during fixation**
Film contaminated with developer before processing
Excessive bending of film*
Static discharge to film before processing
Excessive roller pressure during automatic processing
Dirty rollers in automatic processing

Light Spots

Film contaminated with fixer before processing
Film in contact with tank or another film during fixation**
Excessive bending of film*

Yellow or Brown stains

Depleted developer+
Depleted fixer
Insufficient washing
Contaminated solutions++

Blurring

Movement of patient
Movement of x-ray tube
Double exposure

Partial Images

Top of film not immersed in developing solution
Misalignment of x-ray tube head (“cone cut”)

Emulsion Peel

Abrasion of image during processing
Excessive time in wash water

Reference: White, Pharoah. Oral Radiology principles and interpretation. Fifth edition.
P 105-107

Cidal vs. static antibiotics:

Which of the following antibiotics can be cidal?

- a) Penicillins
- b) Augmentin
- c) Gentamycin
- d) Tetracycline
- e) Erythromycin
- f) sulfonamides
- g) Rifampin

- 1) a,b,c
- 2) a,b,c,f,g
- 3) a,b,c,d
- 4) a,b,g

answer: 2

Antibiotics

In the strictest sense antibiotics are substances produced by various species of microorganisms (bacteria, fungi, actinomycetes) that suppress the growth of other microorganisms. Common usage often includes synthetic antimicrobial agents, such as sulfonamides and quinolones.

Classification of Antimicrobials:

- 1) Agents that inhibit synthesis of bacterial cell walls; penicillins and cephalosporins; cycloserine, vancomycin, bacitracin, and the azole antifungal (clotrimazole, fluconazole and itraconazole).
- 2) Agents that act directly on the cell membrane of the microorganisms, affecting permeability and leading leakage of intracellular compounds; these include the detergents such as polymyxin and the polyene antifungal agents nystatin and amphotericin B, which bind to cell wall sterols.
- 3) Agents that affect the function of 30S or 50S ribosomal subunits to cause a reversible inhibition of protein synthesis; these bacteriostatic drugs are **cloramphenicol; the tetracyclines; erythromycin; clindamycin; and pristinamycins.**
- 4) Agents that bind to the 30S ribosomal subunit and alter protein synthesis, which eventually leads to cell death; these include the **aminoglycosides.**
- 5) Agents that affect bacterial nucleic acid metabolisms, such as rifamicins (e.g., rifampin), which inhibit RNA polymerase, and the quinolones which inhibit topoisomerases.
- 6) The antimetabolites, including trimethoprim and the sulfonamides, which block essential of folate metabolisms.
- 7) Antiviral agents

1) Beta-lactam antibiotics: Bactericidal

Penicillins: Bactericidal; ex. Penicillin G, Penicillin V, Ampicillin, Amoxicillin, Nafcillin, methicillin, oxacillin, Cloxacillin, Dicloxacillin, Nafcillin, Piperacillin

Cephalosporins: Beta-lactam ring, Six-membered ring Resistant to Beta-lactamases/Penicillinases: ex. 1st gen Cefazolin, Cephalexin, 2nd gen. Cefaclor (ceclor), Cefuroxime, 3rd gen Ceftriaxone, cefotaxime, 4th gen Cefepime

Beta-lactam-Beta-lactamase inhibitor combinations: Augmentin (clavulanic acid + amoxicillin), Timentin, Unasyn, Zosyn

2)

3) **Tetracyclines: Bacteriostatic** ex. Tetracycline, Doxycycline, minocycline.

Macrolides: Erythromycin, Clarithromycin, Azithromycin. **Cloramphenicol; Clindamycin, Vancomycin.**

4) **aminoglycosides- bactericidal:** ex. Gentamicin, Tobramycin, streptomycin

5) **Rifampin- bactericidal**

6) **Sulfonamides- bacteriostatic :**

Sulfadiazine

Sulfamethoxazole

Which of the following are TRUE regarding positioning of patients for panoramic radiography?

- a. If the patient is too far forward, the anterior teeth will be smaller and narrower than normal.
 - b. If the patient is too far forward, the anterior teeth will be larger and wider than normal.
 - c. If the patient is too far backward, the anterior teeth will be smaller and narrower than normal.
 - d. If the patient is too far backward, the anterior teeth will be larger and wider than normal.
 - e. Ghost images appear larger on the opposite side and lower than the parent object.
-
- i. a and d.
 - ii. b and c.
 - iii. a, d and e.
 - iv. b, c and e.
 - v. None of these are correct.

Answer: i. a and d.

When the patient is positioned too far forward for a panoramic radiograph, the teeth appear smaller and narrower than expected. When the patient is positioned too far backward, the teeth are wider and larger than normal; in the former case, the spine is also more prominent.

If the patient is not centered, the teeth on one side will appear larger than those on the other, those outside the focal trough being larger.

If the patient's chin is too far down, the anterior teeth will be moved inferiorly giving the impression of a "smile;" the symphysis region may also be cut off. If the patient's chin is too far up, the reverse will happen – the anterior teeth will be too high and give the impression of a "frown;" in this case, the hard palate may obscure the root apices of some maxillary teeth.

If the patient's tongue is not placed against the palate, a dark shadow may obscure the apices of the maxillary teeth.

Ghost images appear larger, higher and on the opposite side of the parent object. Ghost images are created when radiopaque objects outside the focal trough (like glasses or ear rings) are in the path of the radiation used to make the image.

Reference: White SC, Pharoah MJ. *Oral radiology: principles and interpretation*. Mosby. 2000.

Which of the following are TRUE regarding contrast and density of radiographs?

- a. Increasing the peak kilovoltage (kVp) increases density.
- b. Increasing the peak kilovoltage (kVp) influences radiographic contrast.
- c. Increasing the miliamperage (mA) increases density.
- d. Increasing the miliamperage (mA) influences radiographic contrast.
- e. Increasing the exposure time increases density.
- f. Increasing the exposure time influences radiographic contrast.
- g. Fog and scattered radiation increase density.
- h. Fog and scattered radiation increase contrast.
- i. Excessive development causes improved radiographic contrast.
- j. Incomplete development causes improved radiographic contrast.
- k. A light leak or excessively bright safelight will increase radiographic density.
- l. A short gray scale contrast refers to a high contrast radiograph.
- m. A long gray scale contrast refers to a high contrast radiograph.
- n. Subject thickness and subject density affect radiographic density.

- i. a, b, c, e, g, k, l and n.
- ii. a, b, c, d, e, g, j, k, l and n.
- iii. a, c, e, g, h, i, m and n.
- iv. a, b, c, d, e, f, g, k, l and n.
- v. a, c, d, e, f, h, j, k, m and n.

Answer: i. a, b, c, e, g, k, l and n.

Radiographic density refers to the overall lightness or darkness of a film. A darker film has a higher radiographic density. Increasing the kVp, mA and exposure time all increase the density. Thus, answer choices a, c and e are all correct.

Radiographic contrast refers to the range of densities present on a radiograph. A higher range of densities (ie: more variation in light and dark) is referred to as high contrast, while a smaller range of densities is known as low contrast. The main determinant of contrast is the kVp; increased kVp results in a lower contrast radiograph because higher energy photons have more complete penetration of the tissue, causing more shades of gray to appear on the radiograph. Therefore, answer choices b is correct. Both mA and exposure time will increase the density, but since neither affects the amount of energy in the x-rays (and their subsequent tissue-penetrating power), they have no effect on contrast. Thus, both choices d and f are incorrect. It is important to remember that in the above discussion, only changes in one variable are occurring at a time (ie: kVp, or ma, or exposure time, but NOT any combination of these).

High and low contrast radiographs are indicated in different situations. Higher contrast films (lower kVp) are useful for detecting caries and during endodontic procedures because the loss of tooth structure will be better visualized against the surrounding tooth structure. Lower contrast radiographs (higher kVp) are preferred for periodontal and periapical examinations because more shades of gray allows for better visualization of details within the alveolar bone.

Fog is radiation which interacts with the film and does not come from the x-ray source directly. Radiation reflected off other anatomical structures (via Compton interactions) is called scattered radiation. Both darken the film (increasing radiographic density) and decrease contrast. Therefore, answer choice g is correct and h is not.

Mishandling the film during processing by either over- or underdevelopment will result in a loss of contrast. Answer choices i and j are both incorrect. If light leaks or a bright safelight are present in the darkroom, this will further expose and darken the film, leading to increased density and decreased contrast. Therefore, choice k is correct.

A short gray scale contrast refers to a radiograph where only a few shades of gray are present – this is the same as a high contrast film; it is produced with a low kVp (the main determinant of contrast). A long gray scale contrast describes a film where there are many shades of gray present → a low contrast film; it is produced with a high kVp. Choice l is correct; choice m is not.

Subject thickness and density both affect radiographic density, so choice n is correct. Larger, thicker subjects with more bone will have less density if exposed with the same intensity beam as a small, petite patient.

Reference:

- Langland OE, Langlais RP, Preece J. *Principles of dental imaging*. 2nd Ed. Lippincott Williams and Wilkins. 2002.
- White SC, Pharoah MJ. *Oral radiology: principles and interpretation*. Mosby. 2000.

Which of the following are suggestive of a mandibular fracture?

- a. Numbness in the mental or inferior alveolar nerve distribution.
- b. Altered occlusion.
- c. Ecchymosis of the chin, floor of the mouth or buccal mucosa.
- d. Periauricular pain.
- e. All of the above.

Answer: e. All of the above.

In addition, mandibular hemorrhage, abrasion of the chin, mandibular deviation on opening (to the affected side), and mobility or crepitus upon manipulation of the mandible are also signs of fracture.

A thorough evaluation for facial fractures should not be performed until cervical spine examination has been performed and these injuries ruled out.

After that examination, immediate situations should be stabilized – airway clearance and ventilation should be properly examined and managed – this may be as simple as positioning the mandible forward and stabilizing it; vital signs recorded and any excessive bleeding controlled.

A complete history should be recorded including how the accident occurred, when it occurred, the specifics of the injury including the type of object and direction of the impact, whether or not loss of consciousness occurred, and the symptoms of the patient (including pain, altered sensation, visual changes and malocclusion). A medical history, medication history, surgical history, allergies and tetanus status should be evaluated. Neurologic status should also be evaluated (cranial nerve examination).

Specific to the mandible, palpation should be performed in all areas inferior and lateral to the TMJ, paying particular attention to areas of pinpoint tenderness. The occlusion should be evaluated for step-deformities, with particular attention paid if

accompanying gingival lacerations are present. Mobility of segments and teeth should be evaluated as well.

Radiographic evaluation should include a panoramic film, and at least one of the following: anterior-posterior cephalometric film, open-mouth Towne's view, and lateral oblique. Even with all of these films, a mandibular fracture may still not appear.

Definitive management may require maxillo-mandibular fixation and may be best managed by an oral and maxillofacial surgeon. Fixation should not be based solely on aligning bony segments smoothly, but should also focus on developing a proper occlusion.

References:

- Peterson *et al.* *Contemporary oral and maxillofacial surgery*, 4th Ed. Mosby. 2003.
- Pinkham *et al.* *Pediatric dentistry: infancy through adolescence*, 3rd Ed. W.B. Saunders Company. 1999.

Which of the following are helpful when diagnosing fractures of teeth secondary to trauma?

- a. Examination of teeth for mobility and/or displacement.
- b. Percussion to test for periradicular damage.
- c. Recording baseline for pulpal vitality tests.
- d. Radiographic examination to consist of a panoramic film and multiple, angled periapical films.
- e. All of these.

Answer: e. All of these.

Fractured teeth often show mobility, and may be displaced. If the alveolar process is fractured as well, a whole segment of the arch and the included teeth may be mobile. As always, percussion testing can elicit information about injury to the supporting structures to the teeth.

Pulpal vitality testing is often equivocal ensuing trauma. Baseline recordings should be made, but negative responses to cold and/or EPT should not be immediately construed as pulpal necrosis. Normal responses may return within two weeks, but can take up to several months to reappear. Definitive signs of necrosis like periapical radiolucencies or sinus tracts should be interpreted as such and are indications for endodontic therapy.

Horizontal fractures and luxation injuries are difficult to diagnose and confirm radiographically, so multiple films should be exposed at multiple vertical angulations to try to gain as much information as possible about the site of concern.

A definitive diagnosis will require integration of all of the above information.

Reference: Walton RE, Torabinejad M. *Principles and practice of endodontics*, 3rd Ed. W.B. Saunders Company. 2002.

Which of the following is FALSE regarding management after an inadvertent percutaneous exposure incident with a patient who is suspected to suffer from hepatitis B?

- a. The employer must provide post-exposure evaluation and follow-up at no charge to the employee.
- b. The incident must be reported and recorded according to employer protocol.
- c. The patient and employee should have blood drawn and tested for HBsAg, anti-HCV, and HIV antibody and be offered counseling.
- d. The chances of contracting hepatitis C are greater than hepatitis B in a non-vaccinated individual.
- e. All of the above are correct.

Answer: d. The chances of contracting hepatitis C are greater than hepatitis B in a non-vaccinated individual.

This is FALSE. Hepatitis A is transmitted primarily via fecal-oral route and is more common in areas where sanitation is questionable. A percutaneous or permucosal exposure incident is unlikely to cause transmission of HAV.

HBV and HCV are both transmitted parenterally. In non-immunized individuals, the risk of HBV transmission after an occupational exposure incident may be as high as 6-30%. HCV transmission rates are in the range of 2-6%.

Since health care workers are at high risk of HBV transmission, the following are mandated by OSHA: All employers must maintain an exposure-control plan and protect their employees from the hazards of bloodborne pathogens by using universal precautions and providing the following:

- HBV vaccinations to employees
- Post-exposure evaluation and follow-up
- Recordkeeping of exposures
- Generic bloodborne pathogens training
- Personal protective equipment (PPE) at no cost to employees

If an exposure for HCV is suspected, the CDC recommends the following: the patient and the employee should have blood drawn and tested for HBsAg, anti-HCV, and HIV antibody and be offered counseling. No therapy is currently available for HCV.

The risk of HIV transmission via occupational exposure is approximately 0.3%.

Reference: Little JW, et al. *Dental management of the medically compromised patient*, 6th Ed. Mosby. 2002.

Which of the following are regulatory agencies?

- a. ADA and FDA.
- b. CDC and OSHA.
- c. FDA and OSHA.
- d. ADA and CDC.
- e. FDA, CDC and OSHA.

Answer: c. FDA and OSHA.

The ADA is a recommending agency; its mission statement is: “The ADA is the professional association of dentists committed to the public's oral health, ethics, science and professional advancement; leading a unified profession through initiatives in advocacy, education, research and the development of standards.”

The CDC is a recommending agency; its mission statement is: “As the sentinel for the health of people in the United States and throughout the world, [the CDC] strives to protect people's health and safety, provide reliable health information, and improve health through strong partnerships.

The FDA is a regulatory agency; its mission statement is: “The FDA is responsible for protecting the public health by assuring the safety, efficacy, and security of human and veterinary drugs, biological products, medical devices, our nation's food supply, cosmetics, and products that emit radiation. The FDA is also responsible for advancing the public health by helping to speed innovations that make medicines and foods more effective, safer, and more affordable; and helping the public get the accurate, science-based information they need to use medicines and foods to improve their health.”

OSHA is a regulatory agency; its mission statement is: “OSHA's mission is to assure the safety and health of America's workers by setting and enforcing standards; providing training, outreach, and education; establishing partnerships; and encouraging continual improvement in workplace safety and health.”

References:

- <http://www.ada.org/ada/about/mission/index.asp>
- <http://www.cdc.gov/about/organization/mission.htm>
- <http://www.fda.gov/opacom/morechoices/mission.html>
- <http://www.osha.gov/oshinfo/mission.html>